SCIENTIFIC AMERICAN

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THE ELECTRIC LIGHT IN PHOTOGRAPHY.

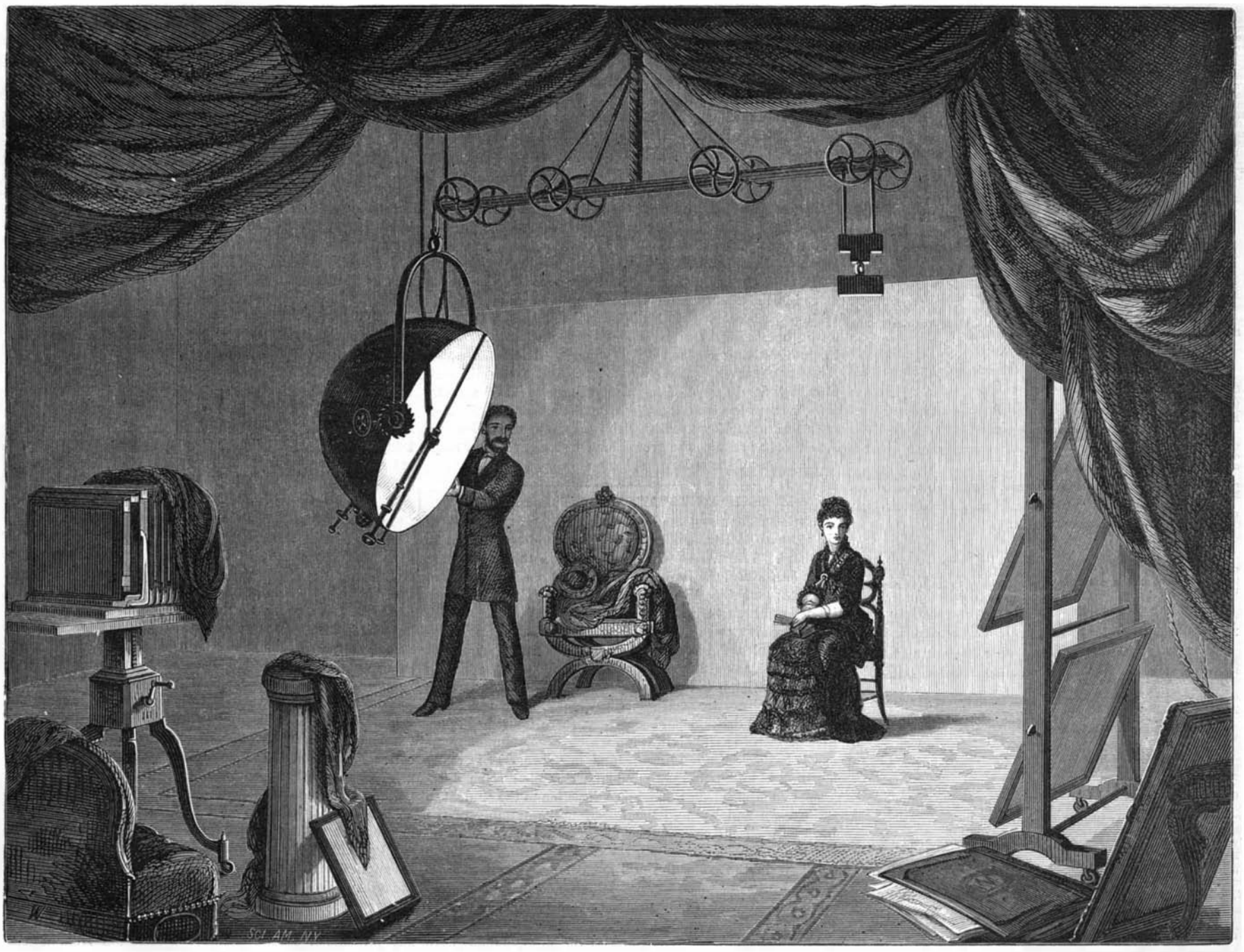
The idea of photographing by the electric light has long been entertained, but the light emanating from a single point renders the shadows too abrupt, and the contrasts too great, to admit of using it in making photographic portraits. Recently, however, the invention of our countryman, Mr. Vander Weyde, for some time in practical use in London, has been introduced in Paris by Mr. Liébert, which diffuses the light, renders it soft and mellow, and imparts to it the particular quality required in making photographic portraits. Not long since we alluded to the fact that it had become quite the fashion in Paris, for parties of ladies and gentlemen to resort to photographic studios, after dinner or before the opera, for the purpose of sitting for photographs, and we now present an engraving of the apparatus employed.

The light used for the purpose is that of the voltaic arc, the lamp being placed in the huge concave reflector suspended by a system of pulleys, levers, and counter-weights, so that it may be readily adjusted or moved about. The reflector is made of opaque porcelain, lined with paper stucco, which is tinted blue. The carbon pencils between which the voltaic arc is formed are placed almost at a right angle to each other. The light has normally a power equal to about 300 to 400 Carcel lamps, but it can be made more powerful by increasing the speed of the Gramme machine.

The light of the voltaic arc is twice reflected. A small reflector placed in front of the lamp throws the light upon the interior surface of the large reflector, whence it is thrown in any required direction according to the will of the operator. The carbons are adjusted by means of screws, so that the maximum effect of the current may be realized, and flickering and variations in the light avoided. The Gramme machine used in connection with this apparatus is driven by a five horse-power gas motor.

A photographer provided with this apparatus is not at the mercy of the weather, neither is he controlled by the time of day, as he has the absolute management of the light. This arrangement of the electric light might be used to advantage in illuminating public places, railway stations, theaters, etc., as the light is very powerful, and yet so diffused that it does not pain the eye.

We give in another column an interesting account of a suit brought by the patentee of this apparatus against infringers in Paris.



PHOTOGRAPHS BY ELECTRIC LIGHT.

Distinguishing Butter from Lard, Beef Fats, etc.

Mr. William Gustavus Crook, public analyst for Norwich, England, describes a method which will in a few minutes distinguish butter from the fat of beef, mutton, or pork, or mixtures of them.

The sample to be examined (if in the form of butter) must be first melted and rendered pretty free from water and salt, by filtration if necessary; ten grains are then to be put into a test tube and liquefied by placing the tube in hot water at about 150° Fah.; remove the tube when ready, and add thirty minims of carbolic acid (Calvert's No. 2 acid, in crystals, one pound; distilled water, two fluid ounces). Shake the mixture, and again place it in the water bath until it is transparent. Set the tube aside for a time. If the sample thus treated be pure butter, a perfect solution will be the result; if beef, mutton, or pork fat, the mixture will resolve itself into two solutions of different densities, with a clear line of demarkation; the denser of the two solutions, if beef fat, will occupy about 49·7; lard, 49·6; mutton, 44 per cent of the entire volume; when sufficiently cooled, more or less deposit will be observed in the uppermost solution. If olive oil be thus tested, the substratum will occupy about 50 per cent; with castor oil, there is no separation. With some solid fats (not likely to be used fraudulently) no separation whatever takes place; the addition of a minute portion of alkanet root will render the reading of the scale extremely distinct by artificial light. The author states that the above method (although not intended to surpass other processes) is capable of wide application, the saving of a large amount of time, and the reliability of its results will at once recommend it as a "first step" in butter analysis.

The Science of Life.

How few of us acquire this science until we are old enough for life to have lost half its charms! The science of life consists in knowing how to take care of your health, how to make use of people, how to make the most of yourself, and how to push your way in the world. These are the things which, the *Herald of Health* thinks, everybody ought to know and which very few people do know. How never to get sick, how to develop your health and strength to the utmost, how to make every man you meet your friend—all these and many other things are to be included in the science of living, and the pity is that we only appreciate it at its true value when the bloom of life is gone.

A BILL, reducing the rate of interest in the State of New York from seven to six per cent, passed the Legislature last winter, and has recently received the Governor's signature. The new act takes effect on the first day of January, 1880.

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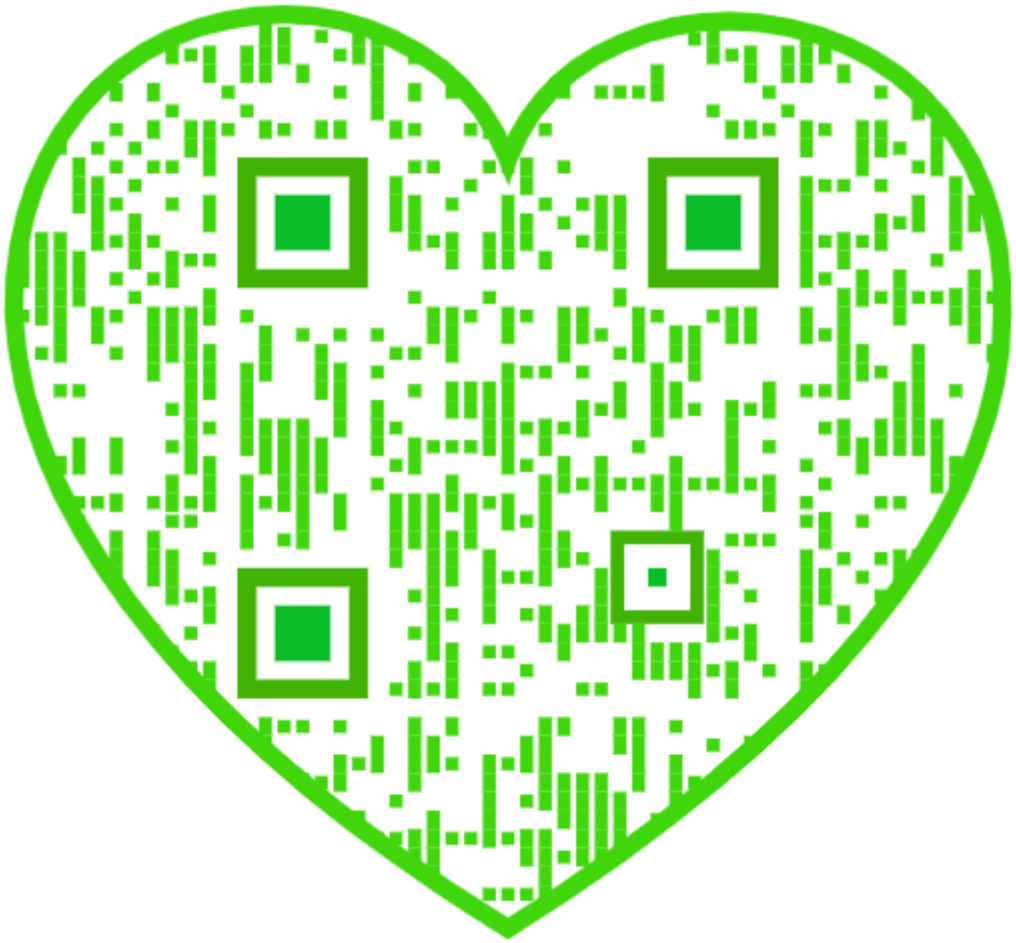

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VOL. XLI., No. 4. [NEW SERIES.] *Thirty-fifth Year.*

NEW YORK, SATURDAY, JULY 26, 1879.

Contents.

(Illustrated articles are marked with an asterisk.)

Acid poisons, antidote for [24]... 59
Air, compressed [2] 59
Amateur mechanics*..... 54
Aquarium, cement for [25]..... 59
Aswail, the*..... 55
Boat propelled by steam jet [1]... 59
Boilers, prevent from rust'g [19]. 59
Boxes to set in wheels [40].. 60
Brick machine, new*..... 50
Bridges, susp'n, bet. N.Y. & B'kl'n 48
Butter, to disting'h from lard, etc 47
Carbolized air 50
Car, steam, novel*..... 50
Cars, action of on curves [33]..... 60
Central system, the..... 52
Cider mill, cloth for [18] 59
Competition, American, in Eng.. 51
Copper, to granulate [35]..... 60
Decease of 2 Am. shipbuilders... 49
Discoveries, curious*..... 57
Drawing tools [38]..... 60
Education, mech'l, advantages of 52
Electric light in photography* . 47
Electric light, photography by the 51
Engineering inventions..... 58
Engine, steam, Exeter*..... 51
Exploration of W. Asia proposed 48
Farming, fancy, advantages of.. 58
Fire-flies..... 49
Flint implements of Aborigines. 48
Fourth of July snow..... 49
Fruit, a tropical..... 49
Good sign of the times..... 49
How business is now done... ... 58
Ice breaker, new*.... 58
Inventions, engineering.. 58
Life, the science of..... ... 47
Lightning arrester [14]..... 59
Lightning rods [20]..... 59
Lobsters for the Pacific Coast.... 55
Mastodon, discovery of another 49
Mechanics, Amateur*..... 54
Mill, an improved*..... 54
Mississippi jetties finished 49
Natural history notes..... 55
No favoritism—no presents..... 48
Notes and queries..... 59, 60
Patents, American, recent 50
Phosphate of potash 51
Photography by electric light.... 57
Photography, electric light in *... 47
Polar expedition, American..... 48
Produce, Am., in Scotland. 52
Progress at Menlo Park*..... 52
Propeller [32]..... 60
Railway risks..... 55
Scale in boilers [36]..... 60
Ships, capacity of [37] 60
Silver, to separate from lead [8].. 59
Sir William Fothergill Cooke.... 48
Steam launch [5]. 59
Steam supply pipe [16]..... 59
Steel, magnesium..... 52
Sun's, the, radiant energy*..... 53
Swift's comet..... 49
Tannic acid in boilers [9] 59
Telegraph mine, the old 51
Typhoid fever 58
Water, compressibility of [6].... 59
Wheels, vehicle, large *vs.* small.. 56

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 186,

For the Week ending July 19, 1879.

Price 10 cents. For sale by all newsdealers.

I. MECHANICS AND ENGINEERING.—Hedge Cutting Machines. 1 engraving
A New Velocipede. 1 figure.
Stopcock of Easy Construction. 2 figures.
A Railway Brick Kiln. 1 figure.
The Gravity Roads of Pennsylvania. Railroads without locomotives.

II. CHEMISTRY AND TECHNOLOGY.—The History of Alizarin and Allied Coloring Matters, and their Production from Coal Tar. By W. H. PERKIN, F.R.S. The first of two important lectures recently delivered before the Society of Arts, London.
Notes on Uranine. By PROF. J. W. MALLETT.
Progress of Industrial Chemistry. By J. W. MALLETT. A review of the most important recent applications of chemistry.—Fuel and methods of burning.—Slag wool.—Metallurgy.—Iron.—Steel.—Wrought and cast iron.—Remarkable appliances.
Phosphorescence, Produced by heat.—By mechanical effects.—By electricity.—Spontaneous phosphorescence.—Phosphorescence by insolation. 2 figures.
Material for Standard Weights and Measures. Black marble.—Rock crystal.—Glass.
Nitrous Oxide as an Anaesthetic Agent.
Purification of Mercury.
Strengthening Alcohol.
The Supply of Nitrogen. By W. D. PHILBRICK.
Beet Sugar in France and Germany. By JOHN SPARROW. Importance of the beet sugar industry.—Methods of Cultivation.—Preservation of beets.—Advantages of beet raising.—How to start and conduct the industry.

III.—GEOLOGY AND GEOGRAPHY.—The Beginning and End of the World. By CAMILLE FLAMMARION. I. The beginning.—Ten million years of life.—Incalculable millions of years anterior to life.

IV. ELECTRICITY, MAGNETISM, ETC.—Prof. Hughes' Audiometer. Researches with a new instrument for the measurement of hearing in relation to the condition and range of hearing in men and animals.
Sounds in the Telephone.
Electric Lighting in Paris.
A New System of Telegraphy. A possible solution of the problem of postal telegraphy.
Physical Society Notes. Suppressing the induction disturbance in a telephone circuit.—New reversing key.—Electric discharges in vacuum tubes, etc.

V. AGRICULTURE AND HORTICULTURE.—Grass Culture. Facts and figures.—History of grass culture.—Methods.—Sowing the Seed.—When to cut grass.
The Castor Bean Plant.—By HON. EDWARD BALLAINE. The plant. Cultivation.—Harvesting.—Popping the Bean.—Yield.—Profit, etc.
Cleansing Trees with Soap. Cost and advantages of soaping trees.
Cheap Charcoal Stove for Conservatory.

VI. ANATOMY AND PHYSIOLOGY.—Food, Physiology, and Force. By DR. E. L. STURTEVANT. An exceptionally instructive paper from the last annual report of the New Hampshire Board of Agriculture.
The Autopsy of an Elephant, By A. J. HOWE, M.D. The anatomy of "The Conquerer." The characteristics of living and extinct elephants.

VII.—ARCHÆOLOGY.—The Standing Stones of Callanish. 1 illustration.

VIII. ART.—The Last Call. Mr. C. B. Birch's group at the Royal Academy, representing a mortally wounded hussar and horse. 1 illustration.

IX. VERSES.—The Owl Critic.

X. LAW.—The Ejection of Passengers from Railway Cars.

THE AMERICAN POLAR EXPEDITION.

On the afternoon of July 8 the steamer Jeannette sailed from San Francisco for a cruise in the Arctic Sea by way of Behring's Strait.

The Jeannette is a bark rigged steamer of 420 tons register, 200 horse power, and admirably constructed for meeting the perils of Arctic navigation. She was built in 1862 by the British Government. She was then known as the Pandora, and made a voyage to the Arctic seas. Last year she was purchased by Mr. James Gordon Bennett, and by special act of Congress registered as an American vessel under her present name. Lieutenant Geo. W. De Long, U.S.N., was, with the approval of Secretary Thompson, placed in charge of her and took her out to San Francisco, where, at Marc Island, she was thoroughly overhauled and put in order for her polar voyage. Her bows were filled in with solid timber, and her hull was materially strengthened by bracing. The engine was thoroughly overhauled, two extra propellers, duplicates of all parts of the machinery likely to break, and a complete set of machinists' tools with stock being also provided.

She has a steam launch, five strong whale boats rigged with sails and boat covers, and a folding boat that can be used in the water or upon runners on the ice. The sails, including rolling topsails that can be furled from the deck, are all new and stout; the spread of canvas is 6,858 square feet.

In the outfit are included eight Arctic tents, each 6 feet by 9, a suit of spare sails, and a number of ice saws with which ice from 10 to 15 feet in thickness can be cut. A deck house roofed over and fastened together by mortises and screw bolts is provided, which can be taken down and put up at will. The cabin and forecastle are padded inside with several thicknesses of felt, and the poop deck is covered with three thicknesses of stout canvas painted over. The ship will be heated by stoves burning soft coal.

The officers of the ship and the scientific members of the expedition are eight in number: Lieutenant George W. De Long, U.S.N., Commander; Lieutenant C. W. Chipp, U.S.N., Executive Officer; Lieutenant John W. Danenhower, U.S.N., Navigating and Ordnance Officer; G. W. Melville, U.S.N., Engineer; Dr. J. M. M. Ambler, U.S.N., Surgeon; Jerome J. Collins, Meteorologist and Chief of Land Parties and Sledging Expeditions; Raymond L. Newcomb, Naturalist; Captain William Dunbar, Ice Pilot. The crew, including seamen, machinists, carpenters, firemen, and coal passers, number twenty, and there are three Chinamen to serve as cook, steward, and cabin boy. The principal officers have all seen Arctic service; and the crew have been carefully selected for their physical and mental fitness for their arduous undertaking. The choice was made from 1,300 applicants.

Special pains have been taken to secure the most perfect outfit possible in the way of clothing and provisions. The ship is provided for three years, and, with the exception of flour and its preparations, all the food stores are in the form of condensed meats, vegetables, and fruits. Ample rations of beer, tea, and coffee will be served. The whole cost of the expedition—in many respects the best equipped that ever set sail for the Arctic regions—will be defrayed by Mr. Bennett.

The grand object of the expedition is to add to our knowledge of the unexplored regions in the neighborhood of the North Pole—if possible to attain to that long sought and apparently unapproachable geographical position. The magnetic and meteorological problems to be studied and possibly solved in those parts are of high importance; and there is no telling what geographical and climatic surprises may not await the plucky voyagers, who have started on the first deliberate assault upon the pole by way of the Pacific. Should the warm current which enters the Arctic Sea through Behring's Strait prove of sufficient volume to have a material influence on the climate within the seventieth parallel, we may reasonably expect that the Jeannette will at least do something to remove the great blank which covers our maps on that side of the pole.

PROPOSED EXPLORATION OF WESTERN ASIA.

A scheme for a systematic and competent exploration of the seats of ancient empire in Western Asia is talked of in England. The success which has attended the exploration of Palestine and the limited research that has been made in other parts of Asia Minor give assurance of grand discoveries to result from such an enterprise. Speaking of the relics already possessed, throwing light on the ancient Babylonian empire, the London *Globe* remarks that they cannot but fill with astonishment any one who will take the trouble to examine them, showing, as they do, that in an age of the world which we are accustomed to regard as an age of all but universal darkness and savagery, there flourished a degree of learning and civilization which seems in many respects to have been but little behind our own. It is really startling to find a library catalogue compiled some 4,000 years ago, appended to which is a direction to the student to write down and hand to the librarian the number of the book he wishes to consult, just as he would have to do today at the British Museum or the Guildhall Library. There are now in the collection at Bloomsbury, Assyrian bass-reliefs testifying to an extinct but advanced civilization to an extent of which comparatively few persons have any idea.

Fortunately the ancient libraries of Mesopotamia were largely made up of tablets composed of clay, and the fact that many of these have survived the wreck of the empires, and the extinction of the learning and civilization to which they testify, and are now in our possession, of course affords abundant reason to believe that Western Asia still possesses hidden treasures of a similar kind, such as would certainly have the most profound interest for every department of learning. So great an addition has recently been made to our knowledge of this old world that it is a matter for wonder that men and money and state influence have not by this time been secured for the prosecution of earnest and extensive exploration.

FLINT IMPLEMENTS OF THE ABORIGINES.

On another page will be found an interesting article on flint implements and their mode of manufacture by the earlier tribes of Indians. Mr. Frank H. Cushing, the author of these researches, is a man only about twenty-three years old, and holds the office of Curator of the Ethnological Department of the Smithsonian Institution, Washington. Up to the time when Mr. Cushing undertook, by putting himself in the identical position of the Aztecs and mound builders—using nothing but sticks and various shaped stones, such as he found on the river banks, to work with—the problem of how these implements of the prehistoric races were made had puzzled the antiquarian student. Mr. Cushing has kindly furnished us the sketches from which our engravings are made, and the description is from the author's paper read before the Anthropological Society at the Smithsonian Institution at its last meeting. We are sure the result of Mr. Cushing's researches will be read with interest by scientists and antiquarians in all parts of the world.

Sir William Fothergill Cooke.

The projector and constructor of the first telegraph line in England, Sir William Fothergill Cooke, died recently. He was born at Ealing, in 1806, and after graduation at the University of Edinburgh, spent five years in the service of the East Indian Army. On his return he took up the study of anatomy and physiology first at Paris, continuing at Heidelberg. At the latter place, in 1836, his attention was directed to the subject of electricity, to which he soon devoted himself exclusively. He constructed an experimental telegraphic instrument, which he took to England and endeavored to introduce on the Liverpool and Manchester Railway. This was two years after Professor Morse had privately demonstrated the success of his invention. Associating himself with Wheatstone, Cooke perfected his invention, so far at least as to make it practicable, and in June, 1837, Cooke and Wheatstone together took out the first patent for an electric telegraph, the mechanism of which, however, was quite unlike that of the Morse instrument. The first line constructed by Wheatstone and Cooke was finished early in 1839, and several other lines had been set up in England before Morse's Washington and Baltimore line was constructed in 1844. Cooke was knighted in 1869, and pensioned in 1871.

The Great Suspension Bridge between New York and Brooklyn.

At a meeting of the Trustees of the New York and Brooklyn Bridge, July 7, the contract for supplying the steel and iron for the suspended superstructure was awarded to the Edgemoor Iron Co. The contract calls for 10,728,000 pounds of steel and 34,000 pounds of iron. The bid of the Edgemoor Iron Co. was $4\frac{35}{100}$ cents a pound, amounting to $468,147. Chief Engineer Roebling said that when the change from iron to steel was first contemplated he supposed that the difference in price would be at least $100,000, but in fact the lowest bid for steel exceeded by only $4,000 the accepted bid for iron last year. The difference between the lowest bid and the lowest bid for crucible steel was $364,000.

Both towers of the bridge have been completed, the last work on the Brooklyn tower having been finished July 5. Mr. Kingsley expressed the belief that through this contract it would be possible to complete the bridge by January 1, 1881. The financial condition of the bridge on June 30 was as follows: Total receipts, $10,623,492.94; total expenditures, $10,523,574.86; outstanding liabilities, $112,807.62.

No Favoritism—No Presents.

Mr. Franklin B. Gowen, the indefatigable President of the Philadelphia and Reading Railroad, who has put himself so emphatically on record against the tyranny of trades unionism, has recently, according to the *Railway Review*, issued an order regarding the employment of new men on his road, which we regard eminently just and proper. Premising that he has discovered that bosses and superintendents have shown great favoritism in the employment of men, setting aside prior and worthy applicants, and giving positions to those who are related to them, or belong to the same society, lodge, church, or political party as themselves, or who have contributed toward making them presents, he calls the attention of those who have charge of the employment of men to the fact that the company "knows neither politics, sect, religion, nor nationality." He says: "Every able-bodied man of good moral character, no matter what may be his politics, nationality, or religion, is entitled to employment (if there is a vacancy) in the order in which his application is made." This is the correct doctrine; and the order which follows should be among the regulations of every railway company. It is, that any superintendent or boss who, in any manner, directly or indirectly, receives any presents or other valuable consideration from his employes, or who may be found unjustly discriminating in the employment of men in favor of his relatives, or in favor of

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any particular party, nationality, religion, or association, shall be summarily dismissed from the service.

It would be well if the proprietors or chief officers in some other branches of business where large numbers of men are employed, would exact similar requirements of their superintendents or under officers.

A TROPICAL FRUIT.

A writer in the *Gardener's Chronicle*, in an article on the edible fruits of the forests and gardens of the Eastern tropics, gives a long and interesting account of that singular fruit the durion. He says that the regal durion (*Durio zibethinus*), like the finest of nectarines or melting pears, must be eaten fresh and just at one particular point of ripeness, and then it is a fruit fit for a king. So highly is this vegetable-custard valued that as much as a dollar each is often paid for fine specimens of the first fruits of the durion crops brought into the Eastern markets. It is a universal favorite with both Malays and Chinese, but the opinions of Europeans vary as to its merits. It is a paradox, "the best of fruits with the worst of characters," and, as the Malays say, you may enjoy the durion, but you should never speak of it outside of your own dwelling. Its odor is so potent, so vague, so insinuating, that it can scarcely be tolerated inside of the house. Indeed nature here seems to have gone a little aside to disgust us with a fruit which is, perhaps, of all others, the most fascinating to the palate when once we have "broken the ice," as represented by the foul odor at first presented to that most critical of all organs of sense, the nose. As a matter of course, it is never brought to table in the usual way, and yet the chances are that whoever is lucky enough to taste a good fruit of it to begin with, soon develops into a surreptitious durion eater. There is scarcely any limit to durion eating if you once begin it; it grows on one like the opium habit or other acquired taste; but, on the other hand, the very suggestion of eating such an "unchaste fruit," is to many as intolerable as the thoughts alone of supping off cheese and spring onions, washed down with beer, and following it by a whiff from a short "dhudeen," by way of dessert.

About the middle or end of July, durion fruits are very common in Singapore, and their spiny skins lie about the streets in all directions. As you pass along you become aware of a peculiar odor all around you—an odor like that of a putrid sewer when half suppressed by holding a perfumed handkerchief to the nose—a blending of a good deal that is nasty with a *soupçon* of something rather sweet and nice. On opening a fruit for yourself, you find that the perfume, like that of musk plant, ceases to be evident after you have once had a fair whiff at it at close quarters. The flavor of the straw-colored, custard-like pulp surrounding the large chestnut like seeds is perfectly unique; and to taste it, as Wallace tells us, is a "new sensation worth a journey to the East to experience." The pulp is sweet, rich, and satisfying, but never cloys; the richness seems counteracted by a delicate acidity, and the want of grape-like juiciness is supplied by the most creamy softness of the pulp as it melts away, ice-like, on your tongue. The durion is one of Dame Nature's "made dishes," and if it be possible for you to imagine the flavor of a combination of corn flour and rotten cheese, nectarines, crushed filberts, a dash of pineapple, a spoonful of old dry sherry, thick cream, apricot pulp, and a *soupçon* of garlic, all reduced to the consistency of a rich custard, you have a glimmering idea of the durion, but, as before pointed out, the odor is almost unmentionable—perfectly indescribable. The fruit itself is as large as a Cadiz melon, and its leathery skin is protected by sharp broad-based spines similar to those of a horse-chestnut. There are many varieties in the Bornean woods some but little larger than horse-chestnut fruits, and having only two seeds; others larger but with stiff orange-red pulp, not at all nice to eat, however hungry you may be, and even the larger kinds, with creamy pulp and many seeds, vary greatly in flavor. The trees vary from 70 to 150 feet in height, with tall, straight boles and spreading tops, and the foliage is oblong acuminate, dark green above, paler and covered with reddish hairs or scales below. The fruits of the finer varieties fall when ripe, and are often the cause of serious accidents to the natives. The clusters of large white flowers are produced about April, and form a great attraction to an enormous species of bat, a kind said to be one of the greatest pests of Eastern fruit-groves. The finest fruits are obtained from cultivated trees.

The tree does well in Sumatra, Java, Celebes, and the Spice Islands, and even as far north as Mindanao. Forests of it exist on the Malay Peninsula, and very fine fruit is brought to Singapore from Siam about July or August. It does not succeed well in India, and cannot be grown in the West Indies.

FIRE-FLIES.

The insects termed fire-flies in America, and which lend such a charm to our summer nights, are soft-winged beetles of the family *Lampyridæ*, which have the property of emitting from the abdomen flashes of soft, phosphorescent light. There are several distinct species of these so-called "fire-flies" indigenous to North America, the most common and widely distributed of which is *Photinus pyralis* (Linn.). This insect most abounds in the Southwest, where, during summer evenings its constantly recurring flashes of light beautifully illumine the air. The perfect insect is of oblong form, somewhat flattened, and varies from ½ to ⅝ of an inch in length. The wing-covers are dull black, margined with pale yellow. The thorax is yellow, with a central black spot having on each side a patch of rose color. The under side of the abdomen is dark brown, with the exception of the two terminal segments from which the light is emitted, which are sulphur yellow. The manner in which the flashes of light are produced is not yet satisfactorily determined, but would seem to be the result of sudden, irregular inspirations of air accompanied by a peculiar voluntary action of certain abdominal muscles. The larva of this species, which may serve to illustrate the larval habits of the family, lives in the earth and subsists mainly on earth worms. It is of an elongate slender form, each joint having on top a horny brown plate, which is ornamented with a central straight line of white, inclosed between two curved lines of the same color. The sides are soft, and rose colored, with the white spiracles situated on elevated brown patches. The under surface is cream color, and each segment is marked in the center with two small brown spots. The thoracic legs are quite long, and the posterior extremity is provided with a singular fan-like proleg, which not only assists in locomotion, but serves to cleanse the head and fore part of the body from the impurities that may adhere after the larva has been feeding. The pupa is formed within an oval cavity in the earth, and is white, with a tinge of crimson along the back and sides. It remains in this state only about ten days. Both larva and pupa have the power of emitting light, though in a much less degree than the mature insect.

The "fire-fly" most common in the more Northern States is the *Photuris pennsylvanicus* (De Geer). In some species of both the genera here mentioned, the females are incapable of flight, the true wings being entirely undeveloped, and the wing-covers very short; while in the well-known glow-worm of Europe (*Lampyris noctiluca*), belonging to the same family, the female retains the larval form, and has the merest rudiments of wings.—*Prof C. V. Riley.*

Discovery of Another Mastodon.

In 1845 the largest and most perfect skeleton of a mastodon ever found was taken from a swamp in the town of New Windsor, near Newburg, N. Y. It was set up by Dr. Warren, and is now in the Boston Museum.

On July 5, the bones of another mastodon were discovered in the same neighborhood—namely, on the farm of Hugh Kelly, at Little Britain, N. Y. The skeleton appears to be nearly if not quite complete, and the separate bones are in fine condition.

The dimensions of the chief parts of the skeleton found are as follows: The skull is 45 inches long, 28 wide, 29 high, and 23¼ between the eyes. The diameter of the nostrils is 6 inches, the nostrils extending into the head 2 feet. Four teeth were found in each jaw in an excellent state of preservation. The enamel is of a bluish tint and unbroken. The four back teeth are eight-pointed, measure 7 by 3¾ inches, and stand 3 inches out of the jaw. The four front teeth are six-pointed, and measure 4¼ by 3½ inches. The depth of forehead is 18 inches; the eye-sockets are 7 inches in diameter, and the ear-sockets 18 inches in diameter. On each side and above the mouth are holes measuring 6½ inches in diameter, from which probably protruded the tusks, which have not yet been found. These openings extend into the skull a depth of two feet. There are eight fangs on each back tooth and six on each front one. The space between the rows of teeth across the jaws measures 7½ inches on the upper and 6¼ inches on the lower jaw. In the center of the forehead is a cavity measuring 11 by 4 inches. It cannot be surmised what this cavity indicates, unless it be for a trunk between the tusks corresponding to that of an elephant. The lower jaw was joined to the upper after they had been unearthed, making a perfect skull. It is estimated that the skull complete will not weigh less than 600 pounds.

The fore-leg, including the thigh bone, measures 7 feet in length, and it weighs, it is judged, 150 pounds. The first joint of the hind leg measures 2 feet 5 inches in length, and the second joint of the same leg 3 feet 4 inches. The only part of the other fore-leg yet found is the second joint, measuring 3 feet 10 inches in length. A dozen or more sections of the spine are among the bones unearthed. The largest measures 10 by 16 inches. A score or more other bones are among the lot, among them that of a toe, measuring 6½ by 4½ inches.

These measurements indicate an animal rivaling in size the one described by Dr. Warren.

Swift's Comet.

In a letter to the *Tribune*, with regard to the comet discovered by him, June 17, Mr. Swift reports, under date of July 5, that from observations made by Professor Hough, Director of the Dearborn Observatory, Chicago, on June 23, and by Professor S. C. Chandler, at Boston, on the 26–30, Professor Chandler has computed the following parabolic elements referred to the mean equinox of 1879:

Perihelion passage—May 20·2115, Washington mean time.

Longitude perihelion	11°	35′	24″
Longitude node	56°	4′	0″
Inclination	70°	38′	3″
Logarithm of perihelion distance			0·09482

Motion retrograde.

These elements resemble those of no comet which has been observed during authentic history. In fact, they differ widely from all recorded comets since 370 years B. C. down to our own time. If correctly calculated the orbit of this comet is parabolic, and the comet is visiting us for the first and last time. It is now receding from the sun rather rapidly, but is approaching the earth somewhat slowly, and will be visible for several weeks, but only through the telescope. Professor Chandler thinks it was at its maximum brilliancy on the 1st of July, when it was just visible with a 2½ inch telescope.

The reader must not lose sight of the curious fact that the comet on the 13th passes quite near the Pole Star and almost exactly over the true pole of the heavens, which accounts for the abrupt change in right ascension.

One very clear night Mr. Swift has seen a broad but very short and faint tail inclined at a considerable angle from a point opposite the sun. On another clear night he was able to see an exceedingly minute star-like nucleus which appeared to be double. Neither of the last two phenomena could be seen except by eyes long trained to viewing faint objects, and then only on nights exceptionally clear and with instruments of fine definition.

Decease of Two American Ship Builders.

With the death of John Dimon, recently, the last of the old-time ship builders of New York passed away. Mr. Dimon was born at Jamesport, L. I., in 1794. He apprenticed himself to Henry Eckford, ship builder, at an early age, and when but eighteen years old was sent by the latter to Sackett's Harbor to help in building the frigates which served in the war of 1812. Afterward, associated with Stephen Smith, Dimon became a prosperous ship builder, building many noted clipper ships, and at a later day many steamships, notably for the Pacific Mail Steamship Company. Mr. Dimon retired from business in 1854. He had for his contemporaries in the palmy days of the ship building trade, among others, the father of Wm. H. Webb, the father of Henry Bergh, the two brothers James R. and George Steers, Jacob Westervelt, and Mr. Mills, who died a short time ago.

An American ship builder of more recent fame, William Cramp, head of the Cramp Ship Building and Engine Works, Kensington, Philadelphia, died at Atlantic City, July 6.

Mr. Cramp was born in Kensington, in September, 1807. He served as a ship building apprentice when that industry was carried on in its primitive stages in the yard of Samuel Grice, which was then the principal establishment in its line in Philadelphia. After attaining his majority he engaged in business for himself, beginning in a small way. During the fifty years he spent in business ship building made great strides, and William Cramp was acute in his perceptions of the wants of a progressive people.

The firm of William Cramp & Sons was composed of William Cramp and five sons. Since the works have been established there have been constructed 225 vessels of every description, including merchantmen, men-of-war for this and other governments, the steamers of the American Line, and Reading Railroad colliers. Five iron cruisers for the Russian navy have been built at the works within the past year.

The Bridgewater, built 27 years ago, and at that time the largest vessel of her class in the country, is still afloat.

The largest iron freight ship ever built in this country is now under construction at this yard. She is to be 2,000 tons measurement, and to have a carrying capacity of 8,000 bales of cotton.

A Good Sign of the Times.

One year ago this month, July, the New York Belting and Packing Company became financially embarrassed, owing to serious losses occasioned by the defalcation of an officer in the Boston Packing Company. A compromise was effected with their creditors, and notes were given for full amount, interest payable at intervals extending to October, 1881. It will gratify the friends of the company to know that they are now enabled to meet all their obligations, and to this end the energetic manager and treasurer, J. H. Cheever, Esq., requests the holders of their notes, whether due or otherwise, to present the same for immediate payment.

Fourth of July Snow.

A sudden and unusual fall of temperature was widely experienced on the afternoon of the fourth of July. At Portland, Maine, it was attended by a fall of snow. Sergt. Boyd, of the Signal Service, explained the phenomenon in this way: Shortly before five o'clock a cloud was observed rising from the south. At the same time another rose from the northwest. The current of wind which bore this along was cold, while the opposing current was warm and saturated with vapor. These two intermingled, and the effect was to form crystals of snow. The preceding heat and dryness of the day also helped to produce this result. The barometer was very low at the time, and the thermometer dropped 15 degrees in 10 minutes. The minimum temperature Friday night was 57°. This sudden change was no less remarkable than the snow-flakes.

The Mississippi Jetties Finished.

Capt. J. B. Eads reports, under date of July 10, that the greatest depth and width of channel required by the Jetty Act at the mouth, and also at the head of South Pass, has been secured. The completion of the great work was certified to the Secretary of War the same day by Captain M. R. Brown, of the United States Engineers, inspector of the work. The jetty channel is over thirty feet deep, and a good navigable channel of twenty-six feet, measured at the lowest stage of the river, exists at the head of the passes. The benefits to commerce likely to flow from this brilliant achievement are inestimable.

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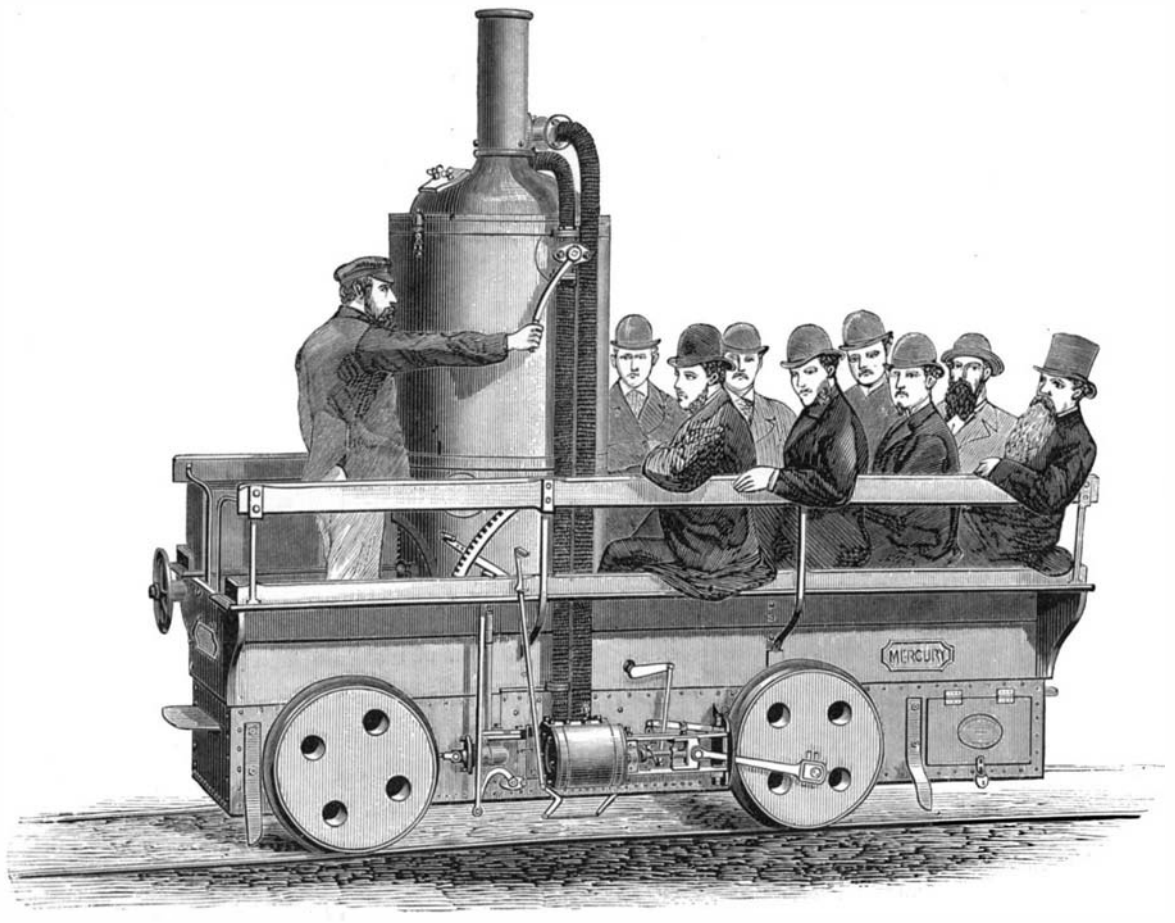
A NOVEL STEAM CAR.

We give herewith an engraving of a novel steam car, designed and built by Ransomes & Rapier for one of the English colonies. It is a combination of engine, tender, brake, and car, all in one, and is said to be the least expensive engine yet made for traveling twenty miles an hour. The boiler is of the vertical type, with ample grate and heating surface. The engine has two cylinders, and is provided with reversing gear and all the other fittings usual in the best locomotive work. The car is mounted on springs, and can be made either open, as shown in the engraving, or closed with roof and glass windows.

With four wheels coupled the engine will draw a load of fifty tons on a level at eight miles an hour.

The machine represented in the engraving will carry eight passengers at a speed of twenty miles an hour. It can also draw two supplementary cars, each containing sixteen passengers, at a speed of fifteen miles an hour.



NEW STEAM CAR.

Carbolized Air.

As an offshoot of Listerism, air which has been passed through liquid carbolic acid is recommended by Professor Sneller, of Utrecht, as a substitute for the carbolic spray. The method suggests itself as a good one. The object of Lister's method is to destroy the bacteria, but the acid employed for this purpose is itself a foreign matter, and, as such, must irritate to a greater or less degree. The carbolized air has the advantage of purity, and is, at the same time, free from objections to the spray. In practice, the air has been found to diminish the bleeding from a cut surface, while the spray encourages bleeding by the moisture it maintains.—*Mich. Med. News.*

A NEW BRICK MACHINE.

The accompanying illustration represents an improved brick machine made by Messrs. Boulet Brothers, of Paris. It consists of three distinct parts—the crusher, the pug mill, and the press, all combined to operate harmoniously together. An elevator carries the clay from the crusher to the pug mill, whence it passes to the cylinder press seen on the right, which forces the clay through a rectangular mouthpiece, and delivers it to the apron in the form of a rectangular prism, which is cut into the required sizes by wires carried by the frame shown at the extreme left of the engraving. Messrs. Boulet were awarded a gold medal for this machine at the Paris Exhibition.

RECENT AMERICAN PATENTS.

An improved shoe, having its upper made of but two pieces of material, opening at the back and adjusted by straps and buckles to fit any ankle, has been patented by Mr. Louis Rose, of Paris, Mo. The object is to furnish a cheap and substantial shoe that can be easily put on and off.

Mr. George E. Wickens, of Tampico, Ill., has patented an improved shirt protector, consisting of an elastic net made of rubber cords or tubes. It is to be worn under the shirt front next to the body, and is designed for keeping the shirt from contact with the body.

Mr. Ebenezer Fisher, of Kincardine, Ontario, Canada, has patented improvements in steel horse collars, which relate to the attachment of the cover or protecting piece to the flanged parts of the collar, also to an arrangement of filling pieces, and other novel features that cannot be described without an engraving.

A novel device for holding doors open has been patented by Mr. Lucian B. Leech, of Smithfield, Pa. It may be adapted to doors opening at different angles. It consists of a spring catch attached to an adjustable bar mounted on a semicircular plate to be attached to the base board.

An improved gate, which may be opened and closed by a person riding in a vehicle, has been patented by Mr. Henry Petry, of Red Oak, Ohio. It consists in a swinging gate having its top bar projecting beyond the rear of the post, and having its end forked to receive a bell crank lever, by which the latch of the gate is operated as the gate is pulled one way or the other by ropes attached to the projecting end of the top rail.

An improved oil can, patented by Mr. Edward T. Jones, of Toronto, Ont., Canada, is made so that it is hermetically sealed when not in use, so that the contents cannot escape either by evaporation or wasting when the can is accidentally tipped over.

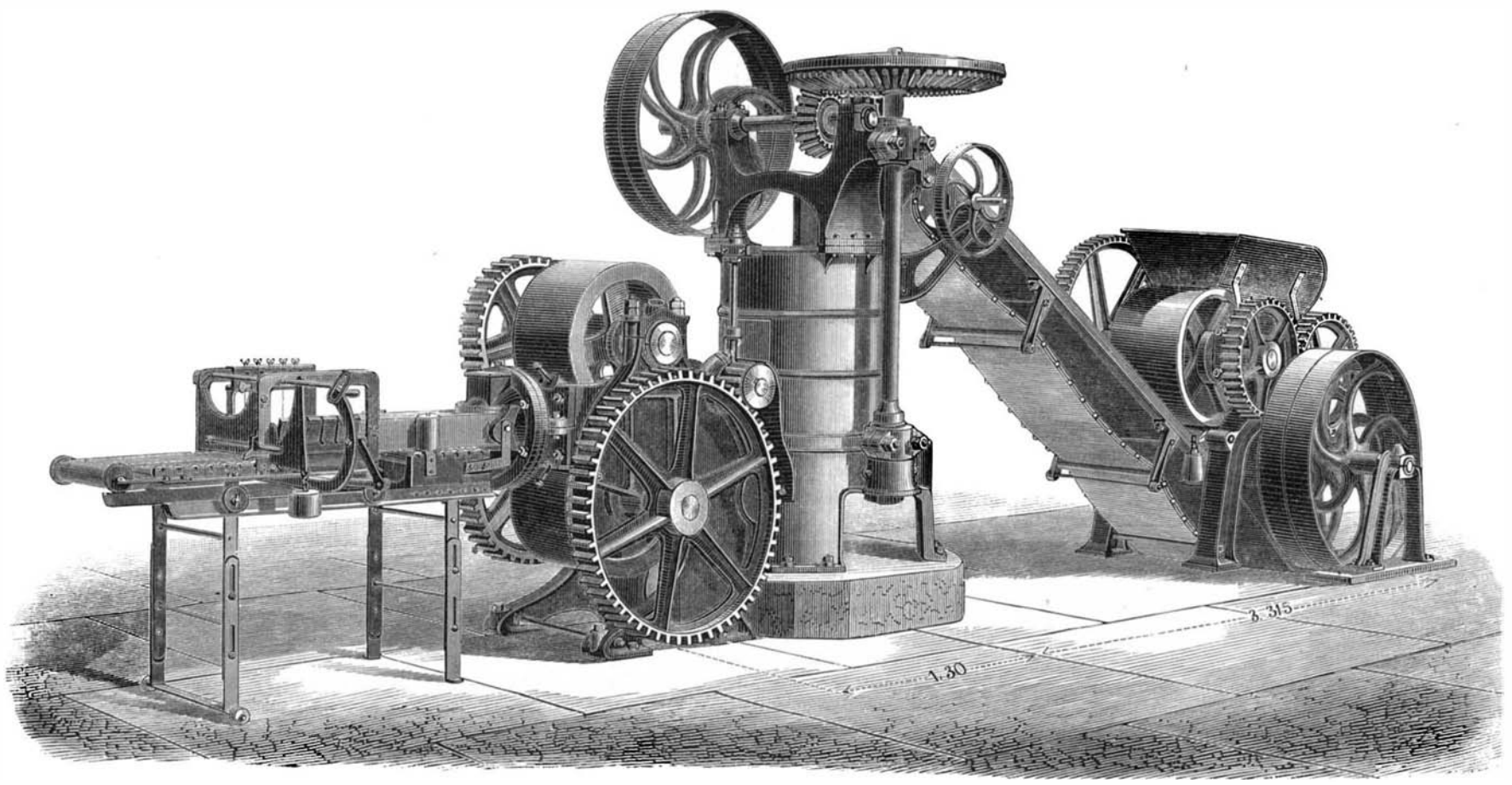
An improved vaginal syringe, in which the discharge tube is provided with a wire guard or shield, has been patented by Mr. John H. Guest, of Brooklyn, N. Y.

A novel gate, patented by Mr. Orlando F. Fuller, of Lamont, Mich., is arranged so that it is opened and closed by the wheels of a vehicle passing over cranks connected with the gate by a peculiar arrangement of chains and pulleys.

An improved apparatus for exhibiting photographic pictures has been patented by Mr. Philipp Costa, of New York city. It is contrived so that the margin of the picture is covered and is provided with a device for intercepting the view while the picture is being changed. It is also provided with stained glass screens through which colored light may be thrown on the picture.

An improvement in hatchway doors, patented by Mr. William H. Cooke, of Wilton, Conn., consists in providing the hatchways with double doors, arranged to slide to and from each other and to be operated by the elevator, which, in ascending and descending, comes in contact with levers fulcrumed in the cleading and connected with the doors, so that the door ahead of the elevator is opened and the one behind it closed simultaneously by the movement of the elevator.

A combined oven door and roaster has been patented by Mr. Henry C. Atkinson, of Franklin, Ky. It consists of a rotary cylinder attached to an oven door for roasting coffee, popping corn, etc.



BOULET BROTHERS' BRICK MACHINE.

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An improved edging tool for leather working has been patented by Mr. Zenas B. Putnam, of Thomaston, Me. The invention consists in a flat cutting blade fitted to a handle, and carrying an adjustable gauge arm, to which is attached a gauge plate that acts as a guide for the knife.

A hog holder, consisting of a stout rod bent into a loop with crossed legs, and having hooked ends, to which is attached a cord or chain, has been patented by Messrs. John R. Wilson and Wilson M. Baker, of Urbana, O. The chain or cord is placed in the hog's mouth, and the loop is turned, forming a hitch over the hog's nose.

An improved hog ring and ringing implement has been patented by Mr. Anthony St. Mary, of Decatur, Ill. The ring in its central section is single, and it widens out toward each end into a two-pronged fork, the prongs being sharpened to facilitate penetration through the septum of the nose. The ringing implement is especially designed for applying this form of ring.

Mr. William Hart, of Berea, Ky., has devised an improved butter stamp, consisting of a cylinder containing a piston which is moved by a screw, so that the thickness of the print can be exactly gauged and its weight indicated.

An improved atmospheric churn dasher, constructed so as to confine a quantity of air while descending, and to allow it to escape and pass through the cream when it begins to ascend, has been patented by Mr. Moses Ray, of Valley Grove, West Va.

Mr. James L. Sprague, of Minneapolis, Minn., has patented an improved rotary churn, having a concave cover provided with air tubes, and having a dasher which propels the cream from the ends of the churn toward the center. The inventor claims that this dasher is much more effective than those of the usual design.

An improved milk cooler, patented by Messrs. Charles L. and Sanford P. Bacheller, of Canton, N. Y., consists in the combination of three concentric pans, provided with connecting pipes, a waste pipe, and water faucet. The pan is mounted on a pivot, so that it may be turned to bring every part of it within reach.

Mr. Gideon E. Wolcott, of De Kalb, Ill., has patented an improved riding plow, which is calculated to cut a uniform furrow in all kinds of plowing, and will turn the last furrow in finishing up the land as evenly as the other furrows. The plow is provided with two oblique furrow wheels, and is arranged so that it may be readily adjusted to its work.

An adjustable window protector and ventilator, patented by Mr. J. L. Walton, of Bolton, Miss. It may be applied to windows of various widths, and it consists of a lattice formed of bars pivoted together diagonally, and having at the ends pivoted jaws and standards to support it in the window.

Mr. George H. Hull, of Montello, Wis., has patented an improved insect destroyer, particularly intended for destroying potato bugs. It consists in a syringe and reservoir combined, so that a constant quantity of the liquid is supplied to the syringe.

Mr. William B. Brown, of Wheat Ridge, Ohio, has patented an improved ventilator for removing vapors and foul air from kitchens, school rooms, and other places. It may be adapted to the ceiling of any room.

An improved copy holder has been patented by Mr. Chas. S. Caldwell, of Wichita, Kan. It consists of a sheet metal tube provided with a longitudinal opening, through which the manuscript projects, the uncopied portion of the manuscript being contained by the tube.

An improved harness coupling, consisting of a T shaped head provided with an eccentrically grooved neck or shank, and adapted to receive and hold a suitable hook, has been patented by Messrs. Frank Reynolds & G. D. Hayes, of Shelby, Iowa.

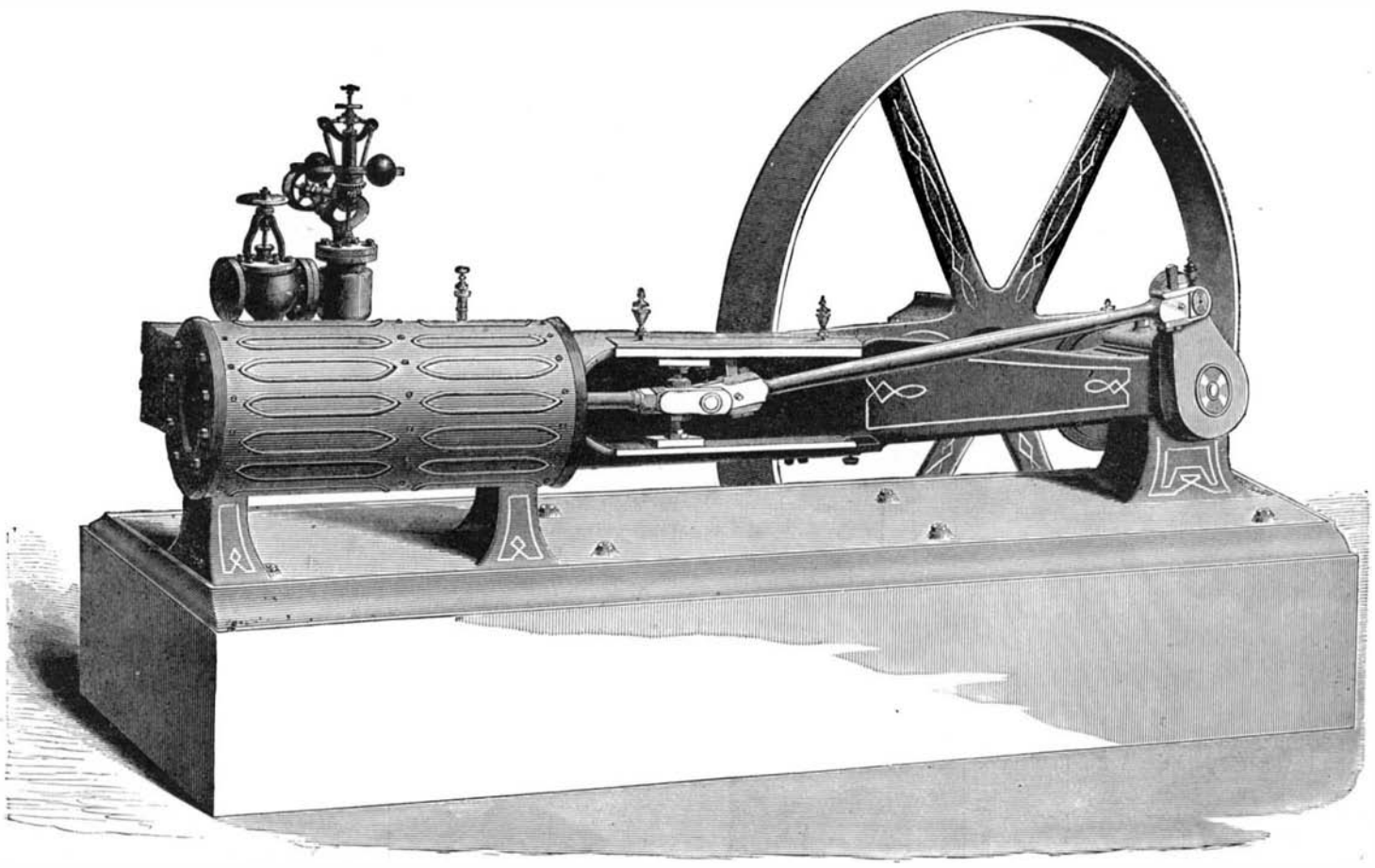
Mr. James Stephens, of Canisteo, N. Y., has patented an improved extension table, which may be lengthened or shortened, and its leaves properly adjusted to either condition without removing them.

Mr. Jean A. Hitter, Jr., of St. Martinsville, La., has patented an improvement in printing telegraphs, in which a type writing machine, previously patented by him, is combined with an arrangement of magnets and telegraphic apparatus.

THE EXETER STEAM ENGINE.

The accompanying cut represents the steam engine made by the Exeter Machine Works, and gives a good idea of its construction and general appearance. The larger engines are similar to the one shown, varying only in those particulars essential to their increased size. They are made from entirely new patterns; and the manufacturers claim that they combine all that is desirable in a steam engine.

The cylinder is accurately bored, and made of more than the ordinary thickness. It is capable of being rebored a number of times, still leaving ample strength for hard work. The cylinder is connected with the main bearing by a rigid casting, which, with the slides, forms one piece, giving the maximum strength and stiffness, and keeping the slides always "in line." The slide casting is separate from cylinder.



THE EXETER STEAM ENGINE.

The piston rods and valve rods are made of steel, and move through composition bushings. We are informed that only the best of materials are used; and where it will add to the efficiency or durability of the machine steel is always used.

As regularity of speed is of the utmost importance in the economy and durability of the steam engine, especial attention has been given to this point; and the makers have provided a governor which maintains a uniform speed under varying load. These engines are very simple, economical in the use of fuel, and may be run successfully by persons of limited experience. The smaller sizes, when used in connection with the "Exeter boiler," do not require the services of a regular engineer.

Further information may be obtained from Exeter Machine Works, 50 Federal Street, Boston, Mass. The manufactory is located at Exeter, N. H.

American Competition in England.

In a recent discussion in the House of Commons, relative to the appointment of a royal commission to inquire into the causes of the agricultural depression and how far they were created by or are remediable by legislation, all sides agree that a great cause of the depression was American competition. Mr. Chaplin said he regarded free trade as a question definitely settled, but he could not shut his eyes to the failure of many of the predictions of the advocates of free trade. He did not propose a remedy now, but only asked for an inquiry. He pointed out that the future fate of British agriculture was dependent upon the cost of production in America. If the cost of importation fell below the cost of production at home, the ruin of British agriculture was not far distant. Liberals, such as Messrs. Brassey, MacDuff, and Duff, blamed the British land system and the game laws for the depression. Their arguments were summed up in a speech by Mr. Bright, who warned the land-owners that the competition of the United States would go on increasing, and the only way of meeting it was to get rid of the stupid and mischievous legislation regulating the tenure and transfer of land. Messrs. MacIver and Bentinck advocated protective measures, but both the Marquis of Hartington and the Government—as represented by Viscount Sandon (Conservative), member for Liverpool, and Sir Stafford Northcote, Chancellor of the Exchequer—declared that no cause had been shown for such measures, which certainly would never be sanctioned. The Marquis of Hartington attributed the depression primarily to the bad season.

The anxiety felt in England with regard to American competition in agriculture is almost paralleled with regard to manufacture. An influential London journal points out that the natural inference to be drawn from recent commercial statistics is, that while American manufacturers are gradually monopolizing the whole of their own markets, and thus ousting from them English merchants, they are also attacking with not a little success the chief centers of demand in Europe. "This latter theory receives support from the fact that in 1878 the States sent abroad cotton, iron, and steel manufactures to the value of nearly £1,000,000 sterling in excess of the previous year's exports. Within a comparatively short period the markets of Europe knew no Yankee products under these heads, except a few miscellaneous 'notions,' which had no appreciable influence on current rates. True, the quantity exported still remains insignificant compared with what we ourselves send abroad. But every trade must have a beginning, and it must be confessed that Cousin Jonathan has made a very good start in foreign business. In cotton, especially, he seems determined to make the most of his advantages, for the quantity produced in the States last year was very nearly double what it amounted to in 1870, although trade was supposed to be utterly stagnant in every branch."

Phosphate of Potash as a Condiment.

Professor Galloway proposes the use of phosphate of potash as a condiment, especially where much salt meat is eaten. He points out that phosphate of potash is the principal material extracted from meat in the process of salting, and holds it evident that it ought to be replaced to give the salted meat its original nutritive value. He also suggests that phosphate of potash will be more useful than lime juice in preventing scurvy. It would be interesting to know whether the Arctic plants, which are such a specific for scurvy, are in this salt.

THE shad hatching camps on the Hudson below Albany were closed Thursday, June 19. It is said that more shad fry have been put into the Hudson this year than ever before. It is also reported that Mr. Seth Green has found a new fish parasite which preys upon brook trout and suckers, eating holes in their sides. It looks like a bat-shaped drop of jelly, and would naturally be mistaken for a little swelling under the skin.

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Advantages of a Mechanical Education.

In this age of iron and steam, the young man who thoroughly understands the nature and manipulation of the former, and the scientific and practical management and application of the latter, need not long be without lucrative employment; provided, of course, he has the moral and physical qualifications for a position of responsibility and trust. While it is true that a large number of the prosperous manufacturers and contractors of this country have never had the advantages of a so-called technical education, such as is afforded by a mechanical college, yet the day is fast approaching, when, as now in Europe, our large industrial establishments, and our boards of public works, will demand a scientific and technical education of the men who direct these undertakings.

As our country grows older men will pay more and more attention to an education which fits them for some definite pursuit in life, and their entire educational course will be framed with this particular object in view. A bent for mechanical pursuits usually manifests itself at a very early period in life; the inclination of the six-year old boy to hammer and pound, to tear open toys and clocks to "see what makes 'em go," all so annoying to the careful parent, may be taken as indications of latent constructive genius, although now manifested in a very destructive form.

In the youth the mechanical bias becomes still more apparent, manifesting itself in attempts to construct wagons, boats, gig saws, small engines, etc. With such a boy a mechanical education is no doubtful experiment; talk to him about it, and he wants to go to a mechanical college at once, where he may learn to be indeed and in truth a competent mechanical engineer.

Just at this point, well-meaning parents, in order to fulfill some preconceived plan, or to do what seems to them prospective of most good for the son, endeavor to force him into some other line or profession, and thus make a third rate lawyer, doctor, or merchant, out of a boy who would have certainly made a first rate mechanic. Of course there is a vast difference between a merely whimsical tinkerer and a youth with undoubted mechanical proclivities; and an observing parent or experienced teacher would have no difficulty in making the distinction. A few queries put by a judicious technical educator would soon reveal the young man's inherent prejudices, and enable him to judge whether the candidate possessed a promising foundation for a mechanical education.

Such a foundation consists mainly in an aptitude for mathematics, a good idea of form and construction, a ready insight into mechanical movements, a positive love for machine manipulation, and a tendency to improve every possible opportunity to witness machinery in motion, coupled with a desire to see into and learn its office and applications.

The above is from *Leffel's News*, to which the editor adds:

There are numerous excellent institutions in this country in which a youth of the character we have described can get the education requisite to develop his natural powers and to fit him to fill a useful and profitable position in the field of practical mechanics; to enter the list as an inventor, or, in time to superintend important public works.

Among these institutions might be named Columbia College, New York City; Stevens Institute of Technology, Hoboken, New Jersey; Cornell University, Ithaca, New York; Rensselaer Polytechnic Institute, Troy, New York; Ohio State University, Columbus, Ohio; and Illinois Industrial University, Champaign, Ill. All of these institutions publish catalogues giving schedule of studies, terms of tuition, cost of living, etc.

Of the students recently graduated from one of the above named institutions—the Stevens Institute of Technology—one is now engaged in a steam-heating and ventilating establishment; another has a position on the Michigan Southern Railway; another is employed as instructor in the Institute; another as a consulting engineer; another in the Midvale Steel Works; another as assistant editor of a technical publication; another in the Franklin Paper Mills; another in the engineer corps of the United States navy; another in the car-shops of the Pennsylvania Railway; another in the manufactory of brick machinery; another as professor of engineering at Yeddo, Japan; another at ship-building works in St. Petersburg, Russia, and another on a survey and exploration of the Western Territories.

The course in the institution just named is somewhat exacting, as indeed it must be to turn out men capable of filling such positions as we have named, but the earnest student has the advantage of association with those who are as enthusiastic as himself, and, as he gets into the higher classes, the *dilettanti* drop out, and those who have in them the stuff out of which competent and successful mechanical engineers are made, move forward to graduation and go out to assume the duties of their vocation thoroughly prepared for their life work.

Magnesium Steel.

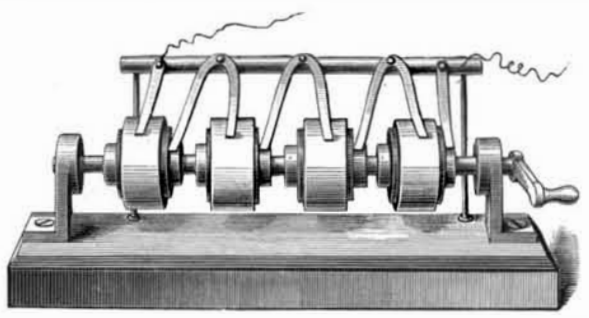
Magnesium also causes a remarkable change of structure in other metals. A coarse-grained steel becomes fine-grained on the addition of one-fifth per cent. of magnesium. In performing the experiments referred to, the magnesium must be introduced through a hole in the cover of the crucible after the oxygen has been first removed by the addition of a few pieces of charcoal. Without this precaution violent explosions are apt to occur.—*Ber. d. Chem. Gesell.*

PROGRESS AT MENLO PARK.

Mr. Edison has wisely kept his own counsels of late, so that very little is known outside of his laboratory as to what goes on within. Occasionally the public gets an idea through the publication of one or two of the scores of patents pending and complete; but these do not indicate the real nature of the improvements that are maturing and soon to be made known.

The electric light and the various matters pertaining to it engross the attention of Mr. Edison and the majority of his assistants; but just at present the electro-chemical or loud-speaking telephone is being made ready for the market. It is a wonderful advance in telephony. It talks as loudly as the natural voice, and repeats the words louder than they were originally uttered at the distant station. As the construction of this curious instrument was described in these columns in detail some time since,* it will be unnecessary

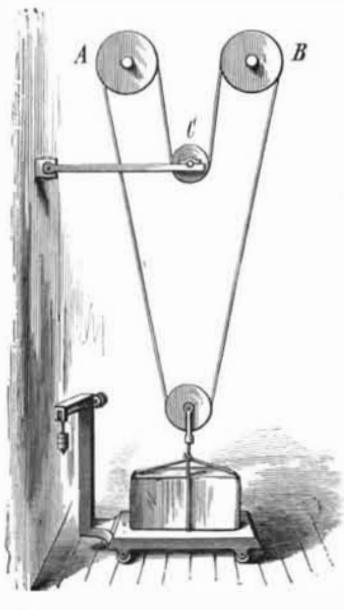
Fig. 1.



to repeat the description here. The telephone depends for its results on the varying friction upon a rotating chalk cylinder, of a platinum faced arm attached to the mica diaphragm of the instrument; the variation in friction being due to electro-capillary or electro-chemical action upon the surface of the chalk effected by an undulatory electrical current proceeding from the secondary wire of an induction coil whose primary is in circuit with a carbon transmitter.

Mr. Edison discovered some peculiar freaks in the receiving instrument which at first puzzled him; but on connecting the binding posts of the telephone with a galvanometer, he found to his surprise that the chalk and platinum rubber of the telephone formed a generator of electricity of no mean order, as it equaled in electromotive force a half of a Daniell cell. He therefore arranged four of the chalk cylinders upon a non-conducting shaft, and connected the platinum rubber of one chalk cylinder with the metallic boss of the next, the terminals being a rubber on one end, and a spring touching the metallic boss of the chalk cylinder at the other end. A series of four chalk cylinders thus mounted and connected (as shown in Fig. 1) is equivalent to two Daniell cells, but the power varies somewhat with the speed at which it is rotated. Mr. Edison is investigating the action of this peculiar battery. He finds that its resistance is 1,200 ohms when at rest, and only 50 ohms

Fig. 2.



when in motion: this is for ⅛ inch metallic surface on the rubber. When this surface is increased to 1½ inch the resistance will be reduced to 1 ohm. Whether the current is due to the decomposition of the solution with which the chalk is moistened, or whether it is due to capillarity or some other cause, has not been definitely determined.

Mr. Edison, in speaking of the electric light, says with a great deal of emphasis, that the system of lighting by incandescence is correct theoretically and practically. It is being perfected in detail, and will before long be exhibited to the public. It would seem from what is at present being done in the Menlo Park laboratory that there are hundreds of points in the problem of electric lighting that have not been considered by experimenters; among these are the proper treatment of the metal or mineral to be subjected to the intense heat required to bring it to incandescence; the insulation and protection of the electrical conductors; the meter for the measurement of the current; and the generator of electricity, which is, after all, the most vital point in the system. Much of the detail of the system has been perfected. The machine which is to supply the current has been completed, and is now undergoing a series of tests to determine its efficiency. Ninety-six per cent of the power applied to the machine is realized in the electric current, and 82 per cent of the power is made available outside of the machine. This is about double the effective exterior current realized by other machines. We hope to give our readers a description of the generator as soon as the tests are completed.

In endeavoring to measure the power required to drive the generator Mr. Edison has tried every dynamometer within reach, and condemned them all. At last, after considerable experiment, he hit upon the simple contrivance shown in Fig. 2. He claims that with this apparatus he can measure the $\frac{1}{100}$ of a horse power. The weighted box rests on the platform scale, and is provided with a pulley for receiving the driving belt, which passes over the driving pulley, A, under the tightener, C, and over the driven pulley, B. The number of foot pounds of power used will be indicated by the lifting of the box and the consequent lightening of the load on the scale. Five per cent is deducted for the angle of the belt and for friction.

Mr. Edison's dynamometer is certainly very simple and effective, but it is in principle something like other dynamometers, employing a weight as a measure of power.

As an evidence of the faith of Mr. Edison and his colleagues in the system of lighting by incandescence, we mention the fact that they have prospectors searching for platinum in all the mining regions of the country.

Mr. Edison is confident that the metal exists in large quantities in this country, and he has sent out circulars which read as follows:

FROM THE LABORATORY OF T. A. EDISON,
MENLO PARK, N. J., U. S. A.

DEAR SIR: Would you be so kind as to inform me if the metal platinum occurs in your neighborhood? This metal, as a rule, is found in scales associated with free gold, generally in placers.

If there is any in your vicinity, or if you can gain information from experienced miners as to the localities where it can be found, and will forward such information to my address, I will consider it a special favor, as I shall require large quantities in my new system of electric lighting.

An early reply to this circular will be greatly appreciated.

Very truly, THOMAS A. EDISON.

MENLO PARK, N. J.

Specimens of platinum and iridosmine sprinkled upon a card were sent with these circulars. The difference in the metals is easily detected with a microscope or magnifying glass.

Many replies, inclosing samples of platinum, have already been received at Menlo Park, and the metal has been found *in situ* in two places. Mr. Edison has a stamp mill and all the apparatus required for reducing ores of various kinds. His facilities for reducing refractory ores and metals are particularly good.

* Vol. xl., page 260, SCIENTIFIC AMERICAN.

American Produce Exported into Scotland.

The landings of cattle, fresh and cured meats, and dairy produce at Glasgow, from New York and Canada, during the month of May, show, according to the London *Grocer*, a considerable falling off as contrasted with the imports in the corresponding period of last year. There were 435 live cattle and 843 live sheep brought over, being 215 cattle and 659 sheep fewer than in May, 1878. Of fresh meat there were 3,250 quarters of beef, and 650 carcasses of mutton, against 7,200 and 475 quarters and carcasses respectively in the same month last year. There were also 3,550 cases of preserved meats, 4,446 packages of bacon, 300 barrels of pork, and 1,900 tierces of beef and hams. Excepting in pork, the import of which was about one-half greater, all the other commodities aggregated not much over one-half the imports during the same month of 1878. The same may be said with regard to the imports of butter and cheese, of which there were 7,561 tubs of the former and 11,200 boxes of the latter, as compared with 10,000 tubs and 20,000 boxes in May of last year. The landings of lard and tallow aggregated 3,000 tierces last month, being a falling off to the extent of fully one-half.

The Cental System.

The Committee on Trade, in a report to the Board of Managers of the New York Produce Exchange, suggest October 1, 1879, as a suitable day for the introduction of the cental system in all transactions in produce bought and sold by weight. The committee recommend that the different trades represented in the Exchange be requested to so arrange their business that all their dealings in grain, flour, meal, provisions, lard, tallow, butter, cheese, petroleum, naval stores, oils, hay, salt, seed, dried fruit, live and dressed stock, freight, storage, and all other articles of produce that are or may be dealt in on the Exchange, and insurance thereon, shall, on and after the date named, be exclusively on the basis of weight, the unit of transactions to be the pound avoirdupois, and the multiple thereof to be the cental or 100 pounds avoirdupois.

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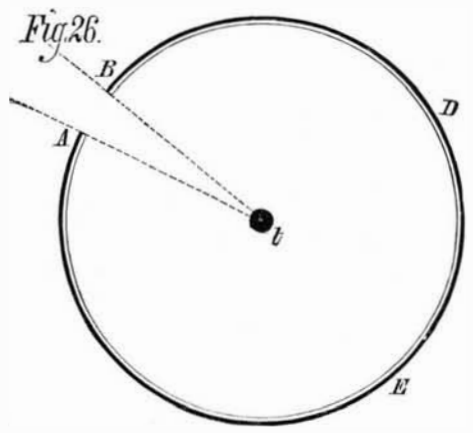
THE SUN'S RADIANT ENERGY.

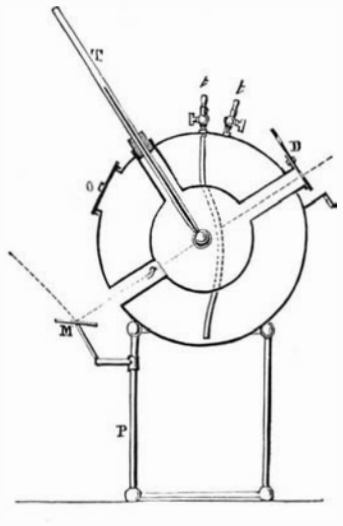
When the spectrum is allowed to fall on a sensitive plate we can, as has been mentioned, obtain a photograph of it, but, unless special means are used, not of all the lines. The photograph obtained with the salts of silver will fail altogether to reproduce the yellow part; will show something of the green and nearly all of the blue; while up in the violet end the picture is very clear, and beyond the violet, where to all appearance the spectrum has ended, a host of sharply defined lines comes out on the plate from a region where the keenest eye sees nothing whatever. This is when the instrument is directed full on the sun (not necessarily on its edge, as in a former experiment), and it would appear at first as if there must be in the white sunlight a special kind of rays, which produced not colors or vision, but chemical changes on the plate, printing there images of the slit, which were produced by something quite different from light.

Fig. 26.



If, on the other hand, we take a delicate thermometer or a radiometer, and move it into successive parts of the spectrum formed by a prism, we find little effect in the blue, more in the yellow, still more in the orange, and as much or more quite beyond the red, where, too, the eye sees nothing. Again, it seems at first that here is another kind still of radiation, causing heat, and which is distinct from that producing light, since one appears where the other does not. In some text books yet in use, diagrams even are given to show the amount of chemical, light, and heat rays in the different parts of the spectrum; but quite recently students of science arrived at a better understanding. The results of old and modern investigations are now seen to point to one conclusion. Given in general terms, this may be said to be that there is, in reality, no such thing as a chemical ray, a light ray, or a heat ray; there is nothing but radiant energy—motion of some kind, causing vibrations across space of something between us and the sun—something which, without understanding fully, we call "ether," and which exists everywhere, even in the "vacuum" of a radiometer. These vibrations are measurable with great accuracy (by processes of which an explanation would be here out of place), and are found to be extremely small in all cases, but to vary among themselves, somewhat as those coarser ones do which have been long known to produce sound. As the high notes of a piano are caused by the rapid vibration of strings, and the low notes by comparatively slow ones, but the sound, whether acute or grave, is due to one thing—motion of the air; so the miscalled "chemical" or "actinic" rays, as well as those which the eye sees as blue, or green, or red, and those which the thermometer feels, are all due to one thing—motion of the ether. Rapid motions exist, which set the molecules of silver vibrating, and are registered by the photograph. These fall also on the eye and on the thermometer bulb or radiometer, and produce some kind of mechanical effect in a minute degree, but not one which those instruments are fitted to register. The longer radiations in turn are not themselves "heat," any more than those which the retina of the eye responds to and calls "light." We have always one and the same cause—radiant energy; and we give this one thing different names: "actinism," "light," or "heat," according as the instrument which reveals its presence to the mind is some chemical substance, the retina of the eye, or a thermometer.

Fig. 27.



Section of Calorimeter.

It will appear, from what has just been said, that there are substances which respond to some of the ethereal vibrations and not to others. The substance which is most generally useful in receiving and, so to speak, absorbing them, is perhaps that which has been recently put to such remarkable use by Edison—common lampblack. Let us try to measure the sun's radiant energy by measuring all of it we can get in the form of heat, and endeavor in the process to reach some idea of the temperature at its surface. There are many ways of measuring the heat, one of which, convenient for its exposition of principles, we give here, though it is not perhaps the best in practice, returning to other methods later.

Thus, in Fig. 26, let A B D E be a large hollow sphere, inclosing a small thermometer at its center, *t*. The bulb is carefully covered with lampblack to enable it to absorb as many radiations as possible, and the inside of the sphere is blackened in the same way. Suppose the temperature of the whole at first to be that of absolute cold or at the natural zero, and that the sphere is kept at that, whatever happens. If we remove a given part of the sphere, let us say one twentieth of the surface area, A B, and fill the aperture with a piece of white-hot iron, this will send heat to *t*, and the thermometer will rise, though not to the temperature of the iron, which, for the sake of illustration, we will call 2,400°. If the whole sphere were at 2,400° the thermometer would also shortly register this (provided we could make one to stand it), but in fact it is receiving such heat from one twentieth of the sphere only, and giving it out by reradiation from the bulb to the other nineteen twentieths, that is, to the whole cold surface around it, which returns nothing. In this case, then, the temperature of the thermometer will be found by reflecting that it gives out very nearly twenty times as much heat as it receives, and that it must register nearly $\frac{2400}{20}$°, or 120°. On the other hand, suppose we, in a new experiment, find the thermometer reads 100°, and want to know the temperature of the iron. We must find what proportion the hole, covered by the hot iron, bears to the whole sphere, and multiply the 100° by this. Were the hole, for instance, in this case but one thirtieth the size of the sphere, evidently the temperature of the hot iron must have been about 3,000°. If the iron were ever so distant, provided it filled the whole aperture to an eye placed where the bulb is, no external rays could fall on *t* except from it. It is immaterial, then, in this experiment, whether the hot body is near or far, provided the hole is always kept so small that no foreign radiation enters. The reader will see the bearing of this when he reflects that if we turn the opening in the sphere toward the sun, with the above precautions, the result will be just the same as if we had plugged the aperture with a sample piece

Fig. 28.

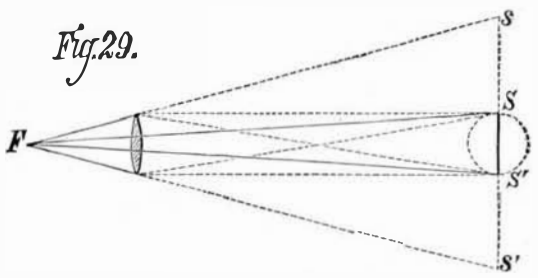
Calorimeter.

out of the sun's photosphere and of its actual temperature. We have now only to multiply the thermometer reading by the number of times the surface of the sphere is greater than the hole, and we have apparently found the real temperature there, as exactly as if we had reached across space and dipped our thermometer bulb into the actual surface of the sun.

There are many drawbacks to this plan in practice, and it is only in case radiation and temperature are proportional that it is sound in theory. Variously modified, however, it is much relied on by experimenters. Fig. 27 gives an internal, and Fig. 28 an external view of the latest construction adopted by M. Violle, of Grenoble, a distinguished recent investigator. In practice the simplicity of our first illustration is widely departed from, and the use of the instrument is much modified. T is the thermometer, whose bulb is at the center of a double sphere maintained at 0° (Centigrade) by a current of ice water circulating through tubes, *t t'*, or by ice put in at 0. D is a diaphragm with various apertures; M, a mirror, in which we view the reflected image of *g*; *g* is a piece of ground glass, on which the shadow of the thermometer bulb falls when the instrument is correctly pointed to the sun. This instrument is capable of being used to give us (according to the method just explained) the temperature of the sun, or else the number of units of heat it sends out. The latter result will be presented, however, by another method subsequently, but before we can do either accurately we must find out how much heat is absorbed by our air. To do this, M. Violle has taken his whole apparatus to the summit of Mont Blanc, and finds there the radiant heat from the sun to that below almost exactly as 4 to 3. The total heat at the boundary of our atmosphere is, according to him, something like one half greater than at the sea level, a rather larger result than one obtained by another means, to be given later.

To find the temperature of the sun from such an apparatus we virtually multiply the thermometer reading by the fraction expressing the ratio of the surface of the sun's disk to that of the celestial sphere, a ratio which is rather less than 1 to 180,000. In the observations of Soret, on Mont Blanc, the inclosed thermometer read nearly 38° Fah. above the temperature of the inclosure, and hence the temperature of the sun's surface would appear to reach at least the enormous number of 38°×180,000=6,840,000° Fah. The more prolonged and elaborate experiments of Mr. Ericsson give a temperature of about 4,000,000° Fah., and indicate that each square foot of the solar surface radiates over 300,000 units of heat per minute; in other words, each foot can furnish heat equal to that required to drive a theoretically perfect heat engine of over 7,000 horse power. There is a very fair agreement among all experimenters as to the amount of heat radiated, but a wide discrepancy as to the temperature, the very same data which above are interpreted as meaning 4,000,000° Fah. being asserted by distinguished French physicists to indicate less than 4,000° Fah. This monstrous disagreement is not due to any considerable error of measurement—all are pretty well agreed on that—but to our ignorance of the laws connecting temperature and radiation. There are two rules in use, one of which was given by Sir Isaac Newton. It says, in substance, that if a body be raised to double its former temperature, it will radiate double its former heat. The other, given by the French physicists Dulong and Petit, is in the shape of a complex formula, which virtually declares that if a body be raised to double its former temperature it will radiate more than double its former heat; in case both temperatures are high, enormously more. Proving that we get enormous heat from a limited area of the sun's surface, then, does not, in the eyes of some physicists, prove that area to be proportionately hot.

Fig. 29.



Action of Lens.

In this there is involved a very practical consideration for us, for this apparently abstruse physical question has a bearing on the duration of the human race, since that duration depends not merely on the present heat of the sun, but largely on the rate at which the sun is spending heat. Suppose some benumbed wanderer to find himself before a fire which seems as if miraculously burning for him, in a cheerless waste, where he would otherwise perish. A fire of straw may be for the moment as hot as a fire of coal; but as the first will spend its stock of heat at once and leave him to die of cold, and the second will spend it slowly and warm him for indefinite time, it is an important thing for him to know the rate at which his fire burns, and this is our own case. The human race—however it came here—finds itself before such a fire, and thus dependent upon it; for it lives on a planet whose proper surface temperature in the absence of solar radiation is variously estimated at from 70° to 273° below zero; and we are all warming ourselves at the sun, without which we should promptly die.

Let us come back to the question of the sun's temperature, then, with a sense of its personal interest to us. We should know more about it if we could carry our thermometer nearer to the sun, but we can practically do so by means of a burning lens, Fig. 29, where S F S' is the real angle subtended by the sun, *s* F *s'* that which it is made to appear to subtend by the lens, so that the effect is nearly that which would be produced by approaching till the solar diameter filled S S'. The actual construction of the burning glass on a very large scale is not now common, as we have other ways of producing intense heat always at command. When made at present they are built up in sections, as in Fig. 30, so as to avoid the necessity of an enormously thick and expensive lens. Such a one as this, in which the lens subtends an angle of about 30°, as seen from the focus, is capable of melting platinum and the most refractory surfaces; and as a great deal of the heat is absorbed by the glass or otherwise lost, if we could approach the sun till it filled such an angle to the eye, we should find the temperature even higher. It is probable that few of the materials of which the crust of the earth is composed would remain in the solid form if carried very much nearer the sun than the presumed orbit of the hypothetical "Vulcan;" and it may be remarked in passing that it is not unlikely that, in case such an intra-Mercurial planet as Professor Watson is said to have recently discovered had an orbit whose nearest approach carried it within 10,000,000 or 12,000,000 miles of the solar surface, it would prove to be heated to the point where it would be self-luminous.

Fig. 30

Section of a polyzonal Burning Lens.

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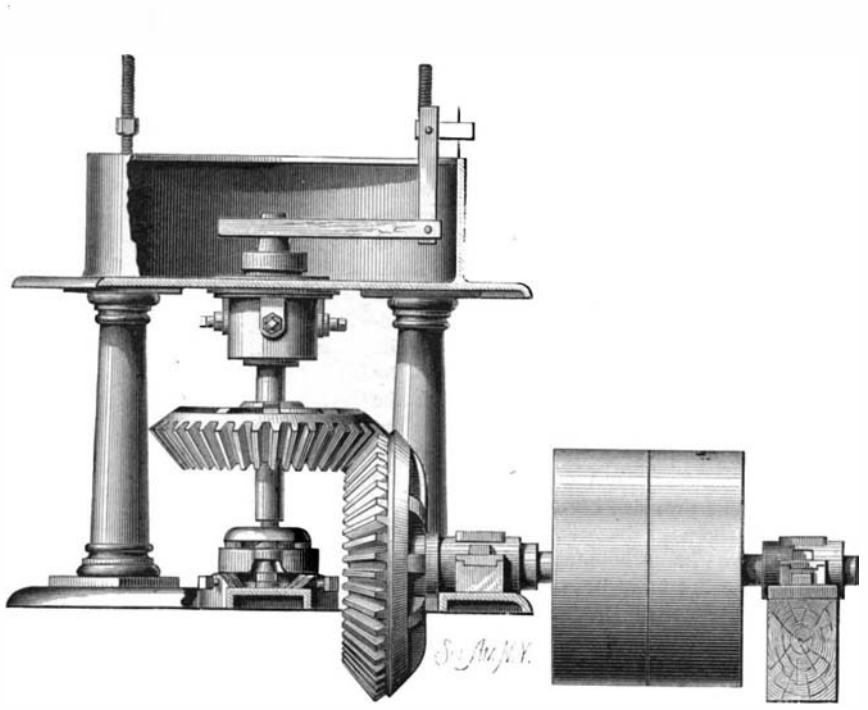
The writer, some time since, made a comparison of the light of the sun with that given from the molten steel in the Bessemer converter. This was chosen as an example of the greatest temperature attained on the large scale in the arts, and it is one which is known to equal that at which platina melts. Looking down the mouth of the converter we see at one stage of the process a stream of molten iron poured into the vessel in which the melted steel is already glowing in the background. Every one knows how bright white hot (and still more melting) iron appears, but in this case the steel is so much brighter, that the fluid iron in front seems like thick chocolate poured into a white cup. The steel, just before it is itself poured, seems of sun-like brilliancy, until we come to compare it with the sun itself, which was done by means of a photometer, so arranged that the steel light shone in at one side and the sunlight on the other. When the angle subtended by each source of light was equal, the image of the molten steel was put out by the presence even of much enfeebled sunshine, and ceased to be visible as the dull flame of an alcohol lamp would be if it were set beside an electric light. The area of glowing metal exposed was considerably over one square foot, and measures made with every precaution showed that any single square foot of the solar surface must be giving out much more, at any rate, than one thousand times the light that the melted steel did.

We are not, it is true, entitled to conclude from this that the heat is in exactly the same proportion, but we are justified by inference from this, and by other experiments not here given, in saying not only that the temperature on the sun's surface is far higher than that reached in our furnaces, but that the heat is in fact so enormously greater than any furnace heat here that they can scarcely be made the subjects of comparison. Other considerations, on which we cannot now enter, give the best grounds for belief that this heat is likely to be kept up sensibly at its present rate of emission for a period which, with reference to the brief history of the human race, may be called almost infinite. These are important conclusions, whose practical bearing will be more fully developed in a concluding chapter.



MUNSON BROTHERS' MILL.

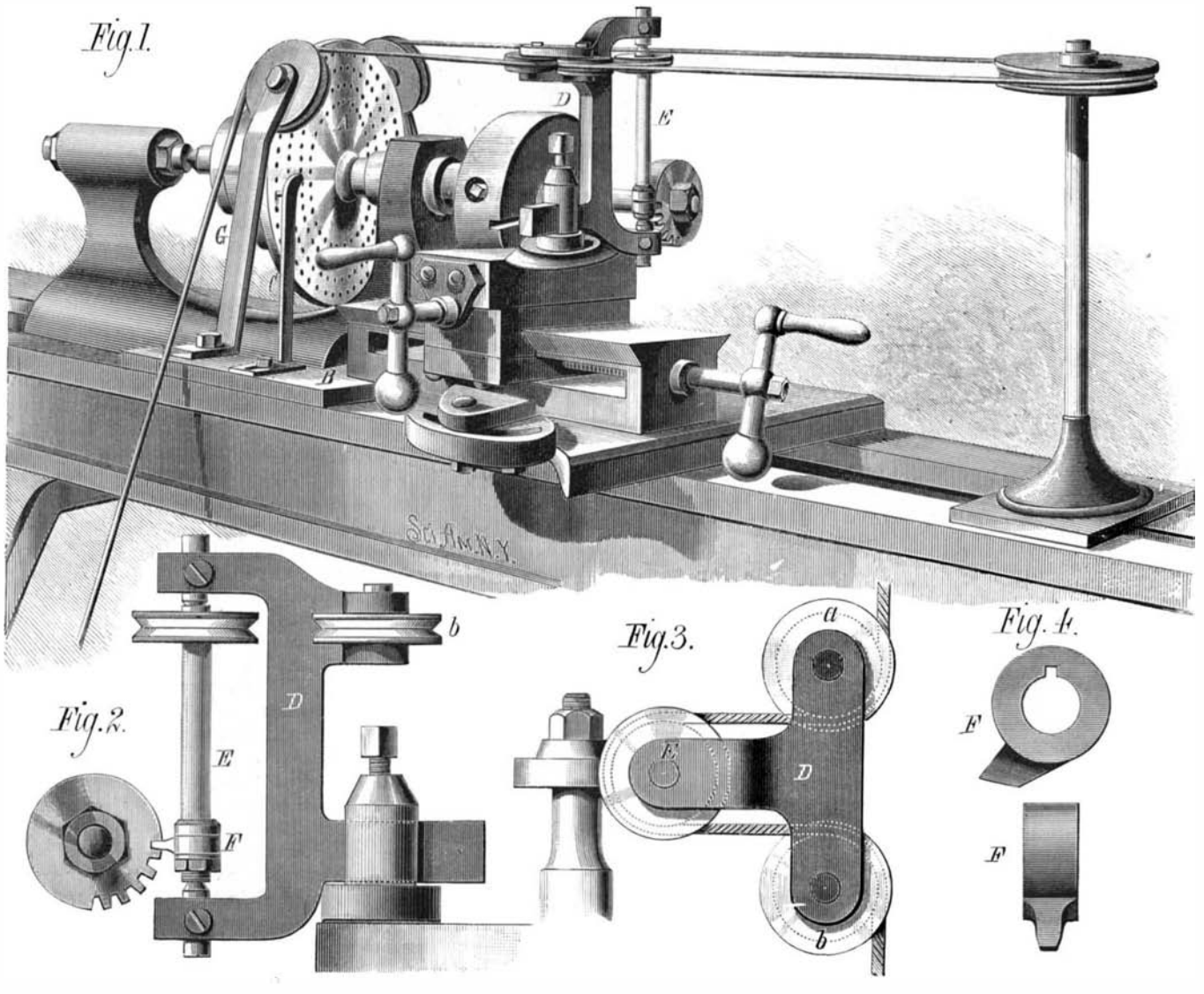
AMATEUR MECHANICS.

GEAR CUTTING APPARATUS.

The index plate, A,* is attached to the larger of the pulleys on the mandrel of the lathe by means of three or four screws, and the stop, C, provided with a point well fitted to the holes in the plate, is held in position on the bed plate, B, by a screw passing through a slot in the foot into the bed piece. The stop, C, is capable of springing sufficiently to admit of withdrawing the pin from the hole in the plate, and it is strong enough to hold the plate without vibration. Two standards, G, mounted on the plate, B, support pulleys over which the driving belt runs. The gear cutter head consists of a casting, D, fitted to the tool post of the slide rest, and the mandrel, E, provided with a pulley and mounted on carefully fitted centers in the casting. The casting, D, has upon opposite sides, near the upper end, ears (as shown in Fig. 3) for receiving the pulleys, *a b*, which guide the driving belt, so that the cutter may be moved across the face of the wheel, being cut without changing the tension of the belt. The extreme end of the loop formed by the belt is supported by the pulley, H, mounted on a standard rising from the lathe bed. The standard may be placed far enough from the slide rest to admit of putting the tail stock between it and the slide rest in case it should be necessary to use the tail stock for supporting the work.

The mandrel, E, is provided with a collar and a nut for clamping the cutter, F. It will be noticed that the cutter comes exactly opposite the line of the lathe centers, and that it occupies about the same position, in relation to the tool post, that the point of an ordinary turning tool does. The cutter, F, is shown in Fig. 4, enlarged. The upper view represents the side, the lower view the edge of the cutter. It has but a single tooth and is adapted to brass and similar alloys only. It may be sharpened by grinding. When iron or steel is to be cut the cutter should have several cutting edges, and the mandrel, E, should have a larger pulley, as more power will be required and the speed must be slower. By setting the slide rest at an angle bevel gears may be cut.

In a subsequent article the subject of sizing and cutting small gears will be treated. M.



APPARATUS FOR GEAR CUTTING.

* See "Index Plates for Gear Cutting," page 20, current volume of SCIENTIFIC AMERICAN.

AN IMPROVED MILL.

We give herewith engravings representing some recent improvements on the Munson mill, which was described in these columns some time since. The late improvements relate to the tramming of the spindle, to a novel device for lubrication, and to other points of merit.

The manufacturers of this mill say that the so-called portable mills now being sold in the market answer very well on coarse grains and coarse grinding, but for fine work they do not meet the demands of the trade; they are constructed without regard to the tramming of the spindles or the importance of keeping them in their true working positions. The metal boxes, which are held up against the collar or the neck of spindles, are continually wearing out, and unless some provision is made whereby the spindles may be perfectly and accurately adjusted, the work performed is of an inferior quality, and the loss of power by friction greatly increased. The Munson mill is made on mechanical principles, and special pains have been taken in their construction to obviate these defects. The curb of the mill, being cast in one piece, has its inside rim turned perfectly true, and by means of a tram stick or index, as shown in our illustration, any deviation or any perceptible change in the position of the spindle, no matter how slight, can be easily detected and easily adjusted.

The spindles are made of solid wrought iron or hammered iron and are provided with inserted solid steel points ground in on a taper fit with emery and oil, making an absolutely perfect bearing, which may be easily removed when injured. The neck or collar is forged solid on the spindle and reamed out to fit within the bush; inside the bush Babbitt metal boxes are placed, which are held up against the collar by set screws. The bush is provided with a central vertical tube around which the collar works, the tube passing up between the collar and the bottom of the spindle, the collar in the bush forming the bearing surface of the spindle. The bush is covered by a cap having a circular central opening through which the spindle passes. The bush once filled with oil will keep the bearing of the spindle perfectly

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lubricated until the oil is entirely exhausted or worn out, with no delays from over-heating, and with no loss of power by friction. The bearings are always cool and work perfectly. These mills are constructed with the under stone hung on a sensitive point or cockhead spindle, or they can be made with the under stone rigid and stiff on the spindle.

For further particulars address the manufacturers, Munson Brothers, Utica, N. Y.

THE ASWAIL.

The aswail, or sloth bear, is found in the mountainous parts of India, and is equally dreaded and admired by the natives of that country. Although a sufficiently harmless creature if permitted to roam unmolested among its congenial scenery of mountain and precipice, it is at the same time an extremely dangerous foe if its slumbering passions are aroused by wounds or bodily pain of any kind. As a general rule the aswail remains within its sheltered den during the hot hours of the day, as its feet seem to be extremely sensitive to heat, and suffer greatly from the bare rocks and stones which have been subjected to the burning rays of the glowing Indian sun. On one or two occasions, however, where the wounded bear had been successfully tracked and killed, the soles of the animal's feet were found to be horribly scorched and blistered by the effects of the heated rocks over which the creature had recklessly passed in its haste to escape from its enemies. On account of this extreme sensitiveness of the aswail's foot, it is very seldom seen by daylight, and is generally captured or killed by hunters who track it to its sleeping place, and then attack their drowsy prey.

The aswail is said never to eat vertebrate animals except on very rare occasions, when it is severely pressed by hunger. Its usual diet consists of various roots, bees' nests, together with their honey and young bees, grubs, snails, slugs, and ants, of which insects it is extremely fond, and which it eats in very great numbers.

Probably on account of its mode of feeding, its flesh is in much favor as an article of diet, and though rather coarse in texture, is said by those who have had practical experience of its qualities to be extremely good.

The hair which covers the body and limbs is of singular length, especially upon the back of the neck, and the head, imparting a strange and grotesque appearance to the animal. The color of the fur is of a deep black, interspersed here and there with hairs of a brownish hue. Upon the breast a forked patch of whitish hairs is distinctly visible. When it walks its fore feet cross over each other, like those of an accomplished skater when accomplishing the "cross roll," but when it remains in a standing attitude its feet are planted at some distance from each other.

These bears seem to be very liable to the loss of their incisor teeth, and even in the skulls of very young animals the teeth have been so long missing that their sockets have been filled up by nature as if no teeth had ever grown there. On account of this curious deficiency, the first specimen which was taken to England was thought to be a gigantic sloth, and was classed among those animals under the name of *Bradypus ursinus*, or ursine sloth. In one work it was candidly described as the "Anonymous Animal." Other names by which it is known are the jungle bear, and the labiated or lipped bear. This last mentioned title has been given to the animal in consequence of the extreme mobility of its long and flexible lips, which it can protrude or retract in a very singular manner, and with which it contorts its countenance into the strangest imaginable grimaces, especially when excited by the exhibition of a piece of bun, an apple, or other similar dainty. It is fond of sitting in a semi-erect position, and of twisting its nose and lips about in a peculiarly rapid manner in order to attract the attention of the bystanders, and ever and anon, when it fails to attract the eyes of its visitors, it slaps the lips smartly together in hopes to strike their sense of hearing.

When captured young it is easily tamed, and can be taught to perform many curious antics at the bid of its master. For this purpose it is often caught by the native mountebanks, who earn an easy subsistence by leading their shaggy pupil through the country, and demanding small sums of money for the exhibition of its qualities.

ASWAIL, OR SLOTH BEAR.—*Melursus Lybius.*

Lobsters for the Pacific Coast.

A large quantity of live black and striped bass, eels, and lobsters from the Atlantic coast have lately been distributed along the California coast. This is the first time that lobsters in good condition have reached the Pacific. Their successful transportation is attributed to the unremitting attention of Mr. Livingstone Stone and his assistants, in whose charge they were. The lobsters were taken at once to Point Bonito, and liberated. On the way to the Point they were placed in a fresh supply of water from the incoming tide, which greatly delighted them. They were all females, ripe for spawning, and were estimated to carry 1,000,000 eggs. The cost of the importation was borne by the California State Fish Commission.

Railway Risks from Defective Vision.

Railway risks from color blindness have attracted much attention of late, and a system of railway signals, using bars at different angles, has been proposed as a substitute for color-signals. Dr. Garretson, of Philadelphia, calls attention to a new source of danger from such signals, arising from the great frequency of the optical defect known as astigmatism.

This condition exists in irregularities of the refracting media of the eye, and is a defect so common as to be met with very much more frequently than color-blindness, the evils of which are sought to be remedied. The eye affected with astigmatism sees bars or lines with clearness only when these are at certain planes with the horizon; lines or bars at other planes it sees dimly or not at all. An astigmatic pair of eyes, having the bar signals alone for a guide, would certainly wreck the train under their direction.

If the new system be adopted, railway officials will owe it to the community, and for the protection of the companies against damages from accidents, to submit every employé for examination by competent surgeons. Accidents arising out of such neglect would assuredly be without excuse.

NATURAL HISTORY NOTES.

A New Theory in Regard to Galls.—Insect galls, which are usually held to be excrescences, a diseased condition of vegetable tissue, resulting from the injection of some fluid or secretion by certain insects, are regarded by Mr. A. S. Wilson, of Aberdeen, in altogether a different light. He says, in a communication to *Nature*, that "all insect galls are in reality leaf buds, or fruit buds, and not mere amorphous excrescences. The vascular lines which would form leaves can easily be followed up the structure of the oak leaf galls. And in cases where the egg has been deposited in the tissue of a young branch, the cap of the gall is sometimes surmounted by a leaf two or three inches long. But in the large blue Turkish galls many lacunæ occur where the fleshified leaves have not filled up the spaces between them. If a dissection be made of one of the weevil galls on the bulb of the turnip, the second or third slice will show the outer foliations, exactly similar to those of the root buds. When the center has been reached, where the maggot will be found, there will also be found a vascular pencil running up from a medullary ray in the bulb, and bearing on its top a bud of the same description as that produced by a ray running out from a root. The insertion of the ovipositor brings a medullary ray into action, producing a tuberculated bud, and it is only the bud which the larva feeds upon. The growth of a bud is an intelligible cause of the growth of a gall, but we can infer nothing from the injection of a fluid. The analogy to leaves is further shown by the fact that various microscopic fungi are matured in the interior of imperforate galls.

Red Canary Birds.—Among the varieties of the canary bird that have recently come into fashion among amateurs is one with red plumage. These birds, according to Mr. Vander Suickt, a Belgian fancier, appeared for the first time at the London Exhibition in 1872. They were exhibited by Mr. Bembrose, of Derby. The birds received no prizes, however, as the jury had doubts as to the origin of their color, and believed them to be dyed. The following year, at the Exhibition held at Whitby, the red canaries were recognized as a new variety, and they became all the rage. In numerous controversies Mr. Bembrose had given his word of honor that the color of his bird was not due to any fraudulent processes, but had been really obtained through a special mode of feeding. But as a friend to whom he had communicated his secret abused his confidence and sold it, the author has believed it his duty to make known to the public the process which he used to obtain his results. It appears, according to him, that the birds are fed upon hard boiled eggs crushed up with the crumbs of common white bread and dusted over with Cayenne pepper. Dr. Dusch, a Belgian amateur, adds the following:

Purchase at the druggist's some of the very best quality of Cayenne pepper, ground very finely; for each meal mix some of it with stale bread macerated in well water, and press it together so that it will crumble, but not form a paste. Instead of bread the white of an egg may be used, if preferred. This kind of food should be given to the bird only before and after moulting. It is well to add that it would be a waste of time to experiment on any other canaries than those of the Norwich breed, or on birds that are not of a very dark yellow strain. This statement is made on the authority of *Les Mondes*.

Insects Destroyed by Flowers.—Mr. J. W. Slater, in a communication to the Entomological Society of London, says: Whilst it is generally admitted that the gay coloration of flowers is mainly subservient to the purpose of attracting bees and other winged insects, whose visits play so important a part in the process of fertilization, it seems to me that one important fact has scarcely received due attention. Certain gayly-colored, or at least conspicuous, flowers are avoided by bees, or if visited have an injurious and even fatal effect upon the insects. Among them are the dahlia, the passion flower, the crown imperial, and especially the oleander. That the flowers of the dahlia have a narcotic action both upon humble bees and hive bees was first pointed out, I believe,

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by the Rev. L. Jenyns, in his "Observations in Natural History." He mentions that bees which visit these flowers are soon seized with a sort of torpor, and often die unless speedily removed. He quotes also a writer in the *Gardener's Chronicle*, who pronounces the cultivation of the dahlia incompatible with the success of the beekeeper. I find it also recorded that the passion flower stupefies humble bees; that bees of all kinds avoid the crown imperial and the oleander, and that the honey of the latter is fatal to flies. I cannot call to mind that I ever saw a butterfly or a moth settled upon the flowers of this shrub in Hungary and Dalmatia, where it is very abundant. It seems not unimportant to ascertain whether the above mentioned phenomena have been verified by other observers; whether any other insects in such cases undertake the functions generally exercised by bees, and whether other flowers have a similarly noxious or deadly action upon insects.

Propagation of Oysters.—Prof. Brooks, of the Johns Hopkins University, has, according to the *Science News*, been recently engaged in experiments with the object of securing the artificial propagation of oysters, and on the 20th of May his efforts culminated in success. Before these experiments naturalists were not fully conversant with the early history of this mollusk's development. A correspondent of the Baltimore *Sun*, who witnessed the process of making embryonic oysters, says in his account of it: Half a dozen on the half shell served on a plate, a few watch crystals, a small glass jar, a little water, and the microscope, constituted the laboratory. The oysters had been taken fresh from their beds and opened carefully. In this way they will live for a day or two if kept in a cool place, and all the while the heart may be seen to pulsate in its cleft next to the muscles. Close to the heart lay what is usually called the "fat," but which is really the reproductive organs. These are wrapped all around the stomach, liver, and digestive organs, the latter being the "belly" or dark part of the oyster. The flaps extending around the whole of one side of the shell are its gills, through which it breathes and separates its food. The mouth is at the butt end of the shells where the hinge connects them. Male and female oysters on the half shell cannot be told apart, and indeed one in fifty is believed to be hermaphrodite. It is claimed that oysters are females when young, and males when they become older and larger. But the facts have not been established with certainty, nor is it of importance. To produce free swimming ciliated embryos the operator pinched away with tweezers a particle of the generative part, put it into a watch crystal, and stirred it until the eggs were well shaken out. The water was now milky from the great number of eggs. The microscope determined the sex, which in the present experiment proved to be male. Under the microscope these male cells appeared to be minute dots perpetually in active motion, and each one of them being sufficient for impregnation when properly lodged. The female eggs are 100,000 larger than the male cells, but are invisible to the naked eye.

Having been washed out into separate watch crystals, the eggs are mixed with the male cells. Then viewed under the microscope the male cells are seen to attach themselves vigorously to the egg in eager crowds, but only one of the many is supposed to impregnate. The first change apparent is the disappearance of the germinal vesicle, and this is accomplished in a very few minutes. The egg then becomes spherical and remains quiet for one or two hours, when a kneading process becomes visible. A globule appears on its surface, and this is the beginning of segmentation. Then by degrees the egg becomes divided into smaller and smaller granules. This process of subdivision occupies two hours, and at the end of this time a small, transparent swimming embryo is found, which is the oyster in its infantile state. The whole process occupies from four to six hours, according to the temperature, although in the present instance it was brought to a successful issue in four hours. Prof. Brooks in his previous experiments had raised oysters till they possessed the cilia which serve to propel the microscopic animal, but they died without further revelation of the mystery of life. In the present experiment he had the satisfaction of developing the embryos until he could clearly trace their digestive organs, and he is inspired with the hope that continued watchfulness will enable him soon to see the infants begin to assume their armor of shells. It is believed that there is no specific time for the spawning season of the oyster, and that it continues throughout the summer months, though this is a point not yet definitely settled.

Correspondence.

How to Hear Lightning in Advance of the Thunder.

To the Editor of the Scientific American:

During a recent thunderstorm at this place I tried, with much success, the interesting telephone experiment suggested in your last week's paper by Mr. G. M. Hopkins. I connected one pole of the telephone with the water faucet in my room, and the other pole with the gas pipe. On applying the telephone to my ear I heard, at every flash of the lightning, a crackling or bubbling sound in the instrument, the intensity of the sound varying with that of the flash. There were also, throughout the storm, frequent minor sounds, indicating lesser electrical action in the telephone; but these minor sounds were unaccompanied by a visible flash.

The thunder sounds were heard from 5 to 30 seconds after the flashes were seen; showing that the center of electrical action was at a distance of one to six miles from my instrument. The water pipe simply connected with a cistern in the ground near my house. The gas pipe connected with the street main, ramifying through the village over perhaps a square mile, but not in the direction of the storm I have mentioned.

A. E. B.

Mont Clair, N. J., July 11, 1879.

Large vs. Small Vehicle Wheels.

To the Editor of the Scientific American:

In a late number of the SCIENTIFIC AMERICAN appeared the question whether a large or small wheel ran the easier. The answer was given in favor of the larger wheel. The principle involved is well known to the carriage builder as being based upon the law in mechanics that regulates the workings of the lever. A wheel is a perpetual lever, the weight, although it is placed upon the hub or axle, is carried to the ground by the law of gravitation in a perpendicular line with the suspension. The obstacles to be overcome in propelling a vehicle create a continuous fulcrum, being a greater or less distance from the weight in accordance with the obstacle surmounted.

To illustrate this principle we have prepared two illustrations. In Fig. 1 is shown an incomplete wheel, the spokes have been driven into the hub, but the felloes have not yet been placed in position. The wheel stands upon two of its spokes. From the hub is suspended a weight of 190 lb; this weight, although placed upon the hub, actually rests

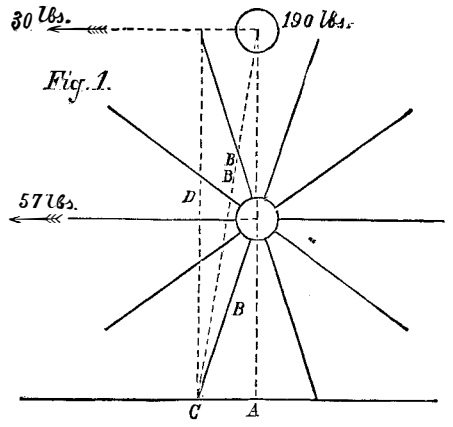
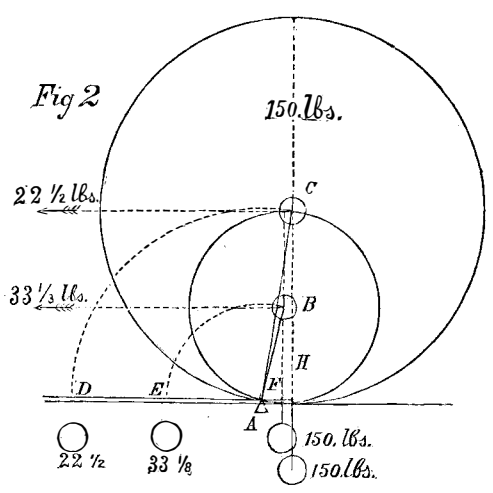


Fig. 1.

upon the ground at A; the end of the spoke, B, forms a fulcrum at C. We wish to raise the spoke, B, to a perpendicular position, shown by the dotted line, D, and in order to do so a force of sufficient amount is applied at E, or the hub, pulling in the direction of the arrow. Now as the distance, A C, is to the distance from the center of the wheel to the fulcrum, C, so is the force applied at E, or the hub, to the weight, 190 lb. We, therefore, find that a force of 57 lb. will move the 190 lb. Now, suppose that the wheel is just twice as large, and that the dotted line, B B, represents the spoke of the larger wheel corresponding with B in the smaller wheel. Applying the force at F in the direction of the arrow, we find that 30 lb. will move the weight of 190 lb.

In Fig. 2, two wheels are represented, the smaller two



feet, the larger four feet in diameter. We will suppose an obstacle is placed upon the track at A; a weight of 150 lb. is placed upon the axle of the smaller wheel, and a force applied at B in the direction of the arrow. This force will be equivalent to 33⅓ lb., while a force of 22½ lb., applied at C, the center of the large wheel, under the same conditions, would accomplish the same object. In order to illustrate the principle more fully, let D A represent the long arm of a lever, corresponding with the spoke of the larger wheel, and A H the short arm. Suspend a weight of 150 lb. at H, and another of 22½ lb. at D, and the lesser weight will balance the heavier. The same with E A F; here, however, a larger weight is required to balance the 150 lb. than with the longer arm, thus fully demonstrating the advantage of a large wheel over a smaller.

GEORGE A. HUBBARD.

New Haven, Conn.

The Old Telegraph Mine.

To the Editor of the Scientific American:

About twenty-five miles by rail, south of Salt Lake City, in the Bingham Cañon, one of the most reliable mines of Utah is located. I refer to the Old Telegraph, which has for many years been well and favorably known in this country as a producer of lead bullion. The mine is reached via the Utah Southern and the Bingham Cañon Railways, the latter road connecting with the former at Junction, a distance of twelve miles from Salt Lake City, and thence it runs to Bingham, thirteen miles distant, up a grade 200 feet to the mile. From Bingham there is a tramway running up the sides of the mountains to the mouth of the mine, more than two miles away. The ore is run down this tramway in small cars, and dumped from their elevated track into the larger cars of the railroad. The accessibility of the Old Telegraph is all that could be reasonably desired. Bingham Cañon is more in the nature of a valley than of an abrupt cañon. The slope is admirably utilized by the tramway and railroad already described, so that the attraction of gravity performs without cost what otherwise would require expensive machinery to accomplish. This Bingham Cañon Railroad was built to meet the necessities of ore shipments from the Old Telegraph, and it has paid for itself more than three times over.

Bingham City is also an outgrowth of this mine, and it is one of the most considerable mining towns in the Salt Lake valley. The property of the mine is about 3,500 feet in length, and the strike of the vein is nearly east and west. The average altitude of the whole mountain in which the mine is located is 6,800 feet. This is divided by deep gulches which offer convenient egress in various places for the ore.

The vein is tapped horizontally by five different levels. The first is the 460 foot level; the second is the 420 foot level; the third, the 360 foot level; the fourth, the 310 foot level, and fifth the 60 foot level. The width of the seam at the 460 foot level is 72 feet, and at the 60 foot level 60 feet. The entire length already opened is 1,710 feet, and about 1,790 feet more is virgin ground yet unopened.

The geology of the whole Bingham Cañon is of the Devonian formation, consisting of quartzite, marble, clay, and limestone. These have been rifted and twisted, by the volcanic action which reared these mountains, into multitudinous forms. The vein of ore is a true vein, of great strength, and practically inexhaustible. The upper part contains less lead than the lower, but is rich in silver. The whole vein averages from 25 to 50 oz. in silver, though in some places the yield is upwards of 200 oz. The average yield of lead is from 40 to 60 per cent. The lead ore consists of carbonate, which, when pure, contains 77 per cent. of lead, and galena, which contains 87 per cent.

The primitive vein material was galena, which was changed into sulphate, carbonate, and chloride by the action of concentrated sea water. Silver is found in the form of sulphate and chloride of silver. Ores containing much chloride of silver are seldom rich in lead, and are, therefore, not smelted, but leached out. The Old Telegraph has a leaching establishment immediately adjacent to the mine, and another one on a larger scale at West Jordan. This leaching process produces sulphate of silver, by the way of solution of hyposulphate of sodium, and precipitation by sulphite of calcium. Under the administration of Mr. L. A. Haldin, the former superintendent and manager of the Old Telegraph, the mine produced in one year $700,000. The average daily output was about 100 tons, or something over $20 per ton net profit. In the year 1876, the mine produced the sixth part of all the lead in the United States, or 10,000 tons in bullion. In 1877 it produced the eighth part, or 11,000 tons in bullion, the general yield being greater throughout the country in 1877. In 1876, 1,000 tons of the ore were analyzed at Pittsburg, by Othon Wuth, with the following result:

Carbonate of lead	50·43
Galena	15·02
Oxide of iron	3·78
Sulphate of copper	0·69
Sulphate of iron	7·37
Quartz	12·47
Clay	3·01
Carbonate of lime	3·64
Sulphate of lime	3·04
Carbonate of manganese	0·26
Water	0·19
	99·88

More recent analyses have been made with practically the same result. The Old Telegraph bullion is esteemed highly throughout the East, and is worth $5 more per ton than any other Utah bullion, because it does not contain antimony, arsenic, or zinc metals, which are noxious to the refining process; and consequently the bullion and ore of the Old Telegraph is sought by refineries and all smelting works in the neighborhood.

About the first of the present year a wealthy French company purchased this valuable mine, and since the 8th of May have been in possession of the property. The management is now taking out over 100 tons of rich ore per day. This operates the tramway to its full capacity and keeps four out of the five furnaces of the smelting works in blast. One hundred men are constantly employed, and preparations are making to increase this number, with additional facilities for a much larger output of ore. It is proposed, at no distant day, to put up three new furnaces, and when this is done the owners of the Old Telegraph will be able largely to command the whole silver smelting of Utah; for there is no good lead in the territory to smelt the silver with except that of the Old Telegraph; consequently, rather than sell their ore to smelt that of other neighboring mines with, they will buy all other ores and smelt them in their own furnaces. This is the true policy of the present company, which they undoubtedly appreciate. The company being one of large resources, the shareholders will not press the management for immediate large dividends, but will be content to wait for more permanent and equally beneficial results.

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Being in Salt Lake City for a few days, I was invited to join a party of ladies and gentlemen who intended looking through the mines of Bingham Cañon. This gave me the opportunity of examining the Old Telegraph, with the foregoing results. At the present time the quantity of ore in sight is something over 2,000,000 tons in the open space.

I saw a body of ore with a face 300 feet long, 56 feet high, and over 100 feet thick. This was in the 310 foot level, in one spot only; and was nearly virgin ground. The temporary agent and manager who represents the French company has introduced many good reforms, such as putting in the waste and saving the timber, while his energy and zeal find indorsement on all hands. He proposes soon to introduce the system of contracts with the workmen which prevails in Europe. He has expressed himself as favoring high wages to good workmen, and this new system of paying by the piece will guarantee this result.

It may be said generally of the Old Telegraph Mine that the temperature is agreeable, the metal easy of access, and readily worked. There is no water in the mine; blasting is not necessary, nor hoisting. But the metal is run down shoots in the inside of the mine from the higher to the lowest level; and outside of the mine down the tramway and railway to the furnaces and concentrating works, being a continuous falling until the ore is changed into bullion.

H. S. W.

Salt Lake City, Utah, June 26, 1879.

CURIOUS DISCOVERIES IN REGARD TO THE MANNER OF MAKING FLINT IMPLEMENTS BY THE ABORIGINES AND PREHISTORIC INHABITANTS OF AMERICA.

At the last meeting of the Anthropological Society at the Smithsonian Institution, Mr. F. H. Cushing, who has made an original and experimental study of aboriginal processes in the manufacture of pottery, stone axes, and flint arrow heads, using only the tools which were within the reach of the aboriginal manufacturers, gave an interesting description of the manner in which flint implements, especially arrow and spear heads, were made by the prehistoric inhabitants of this country and Europe, previous to the discovery or introduction of iron.

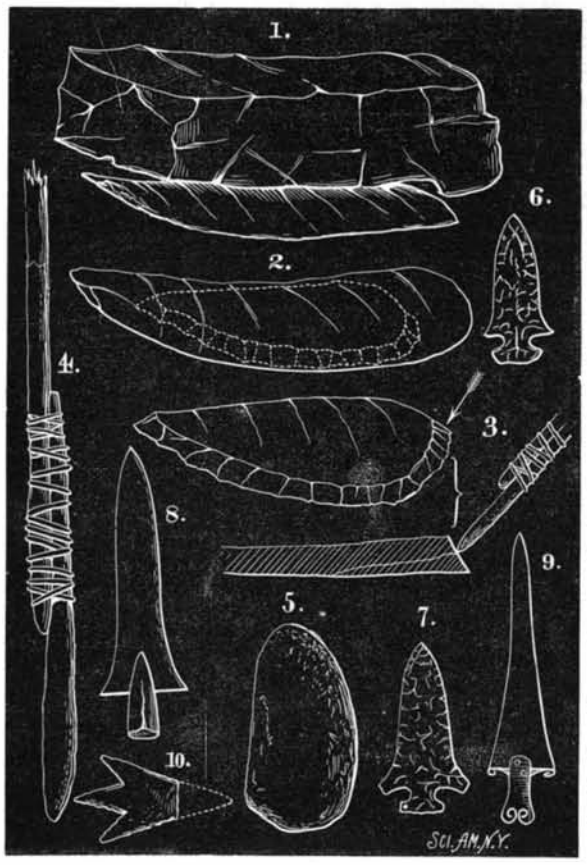
It is the popular impression that flint arrow heads were all chipped into shape by striking off fragments with a rude stone hammer, and this was the method first tried by Mr. Cushing. He found, however, that it was impossible to imitate in this way any of the finer and more delicate specimens of Indian arrows, and that three out of four even of the coarser forms were broken in the process of manufacture. It was evident, therefore, that the Indians had other and more delicate processes. After many unsuccessful experiments, he accidentally discovered that small fragments could be broken off from a piece of flint with much greater certainty and precision, by pressure with a pointed rod of bone or horn, than by blows with a hammer stone. The sharp edge of the flint would cut slightly into the bone, and when the latter was twisted suddenly upward a flake would fly off from the point where the pressure was applied in a direction which could be foreseen and controlled.

To this process Mr. Cushing gives the name of flaking to distinguish it from chipping produced by percussion. And its discovery removes most of the difficulties which previous experimenters had met with in trying to work flint without the use of iron. Spear and arrow heads could, in this way, be flaked even into the most delicate and apparently fragile shapes with a certainty attainable in no other way, and with a greatly lessened probability of breakage. Mr. Cushing then described with the aid of blackboard illustrations all the steps in the manufacture of an arrow, beginning with the striking off of a suitable flake from the mass of material selected, trimming it roughly with a pebble into a leaf shape with a beveled edge, Fig. 2, scaling off surface flakes by repeated blows with a hammer stone upon this edge at right angles to its plane, Fig. 3, and finally finishing, pointing, and notching the arrow head with the bone flaking instrument previously referred to.

Surface flaking, which is the thinning of the unfinished arrow by the detachment of flakes running from the edge to the center, is the most difficult part of the whole process. Arrows upon which no signs of it appear were always the work of beginners. It may be produced either by direct blows with a hammer stone, by pressure with a flaker, or by a combination of the two methods, the hammer being used with the flaker as if the latter were a stone chisel. Each of these methods leaves its unmistakable mark upon the finished implement, so that it is easy to determine by simple inspection of the chipped article to what degree of perfection the art had come at the time when it was made. Thus it can be proven that the marvelously chipped axes of the Danish shell heaps were produced by using a horn flaker as if it were a stone chisel, by striking it with a hammer stone, while the beautifully finished daggers, arrows, and spear heads from the same region had been flaked by a combination of the latter process and pressure, and that when the paleolithic flint implements found in the drift were made, the art of using the flaker in either of these methods had not yet been discovered. Hammer stones, however, which bear marks of having been used for chipping, are found everywhere where arrow or spear heads occur, showing that savages universally pursued the method followed by Mr. Cushing, of first blocking out the implement with a hammer stone, whether they afterward used a flaker to finish it more perfectly or not. Since, therefore, all the specimens found in the great "deposits," or *cachés*, throughout this country bear marks of the hammer stone, but not of any other instrument, they may be definitely regarded as unfinished articles laid by for future completion.

The various processes and implements used in chipping and flaking had grown out of the difference of material to be worked. Where the latter was tough, as was the case with the hornstone of Western Arctic America, it could not be flaked by pressure in the hand, but must be rested against some solid substance, and flaked by means of an instrument the handle of which fitted the palm like that of an umbrella, enabling the operator to exert a pressure against the substance to be chipped nearly equal to the weight of the body. Thus the T-shaped wooden-knife flaker of the Aztecs was the outgrowth of the easily worked obsidian; and the slender horn flakers of California and the Southwest, of the fragile chalcedony and jasper of that region.

Material often contained small masses of harder or tougher substance. Where these occurred the ordinary flaking was likely not to remove them, in which case they formed objectionable protuberances on the unfinished arrow point. When nearer one edge than the other, their removal was attempted by chipping into that edge, thus making the arrow head onesided. The almost invariable occurrence of traces of such protuberances on the edge most chipped of these unequal specimens was evidence that this, the so-called "knife type," was of accidental origin.



THE MAKING OF FLINT IMPLEMENTS.

1. Mass and flake; 2. Leaf form; 3. Surface flaking; 4. Flaker, upper end wood, lower end horn; 5. Chipper (pebble); 6. Bell-shaped Stone age spear; 7. Bell-shaped spear; 8. Bronze age spear; 9. Modified bell-shaped dagger, bronze; 10. Example of accidental chipping.

Most if not all of the so called "turtleback" implements which had been regarded by archæologists as designed for special purposes, were really articles never finished because of the presence of such prominences on the center of one side or the other.

Where these irregularities appeared on the middle of the side of a specimen of choice material, or on which much labor had been expended, its removal was undertaken by the chipping down of both edges, thus resulting in the bell-shaped outline of spear head, Fig. 6, so much admired by archæologists, which being recognized by savage manufacturers as ornamental, was afterward purposely produced, and even survived in the weapons of the bronze age, Fig. 8, or that period immediately following the age of Stone.

The difficulty of making long narrow surface flakes made it much easier to form narrow and delicate points than the larger, though even ruder forms on which much surface flaking was necessary, and the slender fragile perforators which had been regarded as inimitable by any existing race were really the most readily and rapidly made of all.

In flaking a large arrow or spear head in the hand it was necessary to hold it alternately by the point and by the base. As the grasp by the base was much firmer, the pressure was greater, and hence the flakes scaled off further toward or over the center, and as this unavoidably happened on opposite edges of the specimen, a twisted and even at times distinctly beveled point was the result when hard material was flaked. This not only accounted for the beveled type of spear head so common in Tennessee, but also indicated that wherever this type occurred the method of flaking was by pressure in the hand and not as among the Esquimau and Kjockkenmoedding people.

Mr. Cushing added that since all specimens of this kind were found to be twisted one way—from right to left—the inference was unavoidable that the aborigines who made them were, like ourselves, a right-handed people, and that wherever this form occurred the method of flaking by pressure in the hand must have prevailed.

Prof. Mason here mentioned that he had seen two examples beveled from left to right, indicating, of course, an occasional left-handed individual.

Mr. Cushing then explained how it could be known on examination whether an imperfect arrow had been broken during the process of manufacture or by use.

He then referred to an archæological publication recently (1868) printed in Spain, on the covers and title page of which appeared the figure of a three-pointed arrow. This had been regarded as one of the most important archæological discoveries of that year, and its figure adopted as the seal of the book. But had the members of that Spanish society and the author been practically familiar with flint chipping, they probably would not have regarded as so rare the inverted base of a common barbed and stemmed arrow head, from which the point had been removed by accidental chipping (Fig. 10).

Arrow flaking was accompanied by great fatigue and profuse perspiration. It had a prostrating effect upon the nervous system, which showed itself again in the directions of fracture, and it was noteworthy that, on an unimpressible substance like flint, even the moods and passions of centuries ago might be found thus traced and recorded.

Mr. Cushing then closed his remarks by calling attention to the use of the study and practice of the art of arrow making in establishing the groundlessness of all archæological classifications of chipped articles, based on diversity of form alone, or of attributing distinct or definite uses to types of form thus established, which these investigations proved to be the results only of constantly or imitated recurring accident.

Photography by the Electric Light in a French Court of Justice.

The question whether the Vander Weyde system of the application of the electric light to photography is or is not public property, is one which is just now forcibly occupying the attention of the photographic world in France. And there is much reason for this, for the question possesses more than one interesting aspect: There is, in the first place, the point of law as to what rights are attached to a patent taken out in France, and then there is the doubt as to the line of conduct to be pursued by photographers who desire to work the electric light in their own studios.

Naturally there was some excitement at the thought of the advantages which operators by the electric light would be able to possess, once it was completely established that by a new process really practical results could be obtained. It was remembered that the ill success of the first attempts to introduce the electric light into photographic work had caused them to be quickly abandoned, and that since then they had never been renewed. In the English Department of the late International Exhibition at Paris there were shown some photographs taken by the Vander Weyde system, and professional photographers were astonished, for all the artistic conditions which were formerly wanting were now combined in them. Thanks to the special organs of the press, in which the *Photographic News* was one of the most active in bringing before the public the merit of the invention, it was learned that the technical requirements had been satisfactorily complied with by the new process, and that the employment of the electric light in photographic operations would henceforth be feasible; arguments—or, rather, proofs—not to be refuted were forthcoming. Some time ago, it is true, photographs had been taken by the electric light; the fact that this peculiar manifestation of energy could be successfully substituted for daylight was well known. But the apparatus used only allowed a pencil of rays to be emitted in a confined space, and the result was not what in photographic language is called "clean work." The great problem to be solved was that of the diffusion of the light, and this was successfully accomplished by M. Vander Weyde. According to the *Times* of the 25th of December, 1877, in an article containing an account of this valuable invention, M. Vander Weyde took out his patent in England on the 1st of February of the same year.

In France the discovery was only honored from afar. People rejoiced at the idea that photographers would henceforward be independent of the changes of light, and would be able to work at any hour and during any kind of weather. There were, indeed, some who, before the Vander Weyde discovery, had rendered the assertion possible—and, indeed, even before electricity had been thought of at all for the purpose—placarded the startling absurdity, "*Dull weather is the best,*" in large brilliant letters illuminated by gas; but it was merely a means of advertisement, and gave occasion for many a laugh among professional photographers. Business men, whose time, during the hours of sunlight which were propitious to the operator, is fully occupied, were prohibited from even going to the photographer, however desirous they might be of having their portraits taken; ladies could not realize their wishes of being represented in evening dress unless they put it on in daylight; actors and actresses, whose costumes are intended to produce an effect by the illumination of the foot-lights only, were compelled, much against the grain, to endure their finery in the full glare of the sun. In France, then, we have been content to stand on our old lines, though we still tried to emulate the photographic feats of the electric light in England.

All the advantages of the process, however, much as the French photographers appreciated them, they could only hope to realize by the employment of an electrical apparatus giving a sufficiently diffused, and at the same time intense,

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light to produce a photograph. This was well known, and yet the old misleading ways were followed. At length the patent right for France of the Vander Weyde system was bought by M. Liebert, who, of course, supposed that he had purchased also the right, not only of working the process for his own profit, but also of granting licenses to others to do so. He therefore inaugurated sittings for the press, and gave a splendid fête—a description of which appeared in the *Photographic News*—in order to give publicity to his new system, which certainly was deserving of all the honor that he showered upon it; in short he made as much noise as he possibly could, as is the case with every adventurous speculator or fashionable artist. But, on the other hand, M. Pierre Petit has done all this without having purchased anything. At the grand fête held on the 8th of June last, at the Paris Opera House, on behalf of the sufferers by the Szegedin inundations, M. Petit exhibited the whole process. It struck him that it would be an excellent occasion for killing several birds with one stone. He would give those who attended the fête the opportunity "*faire sa photographie à la l'électricité*," as says a curious song just now popular at the Alcazar; he would be largely aiding the charity; and he would be advertising the new process so as to benefit himself. But M. Liebert, who had bought the sole right of taking photographs by the Vander Weyde system in France, was not one to allow what he considered an infringement of that right. He therefore applied to the President of the proper tribunal, and having explained that M. Pierre Petit had not acquired the necessary license for working with an apparatus for producing the electric light, which was a mere copy of that of M. Vander Weyde, he obtained a legal injunction, and the services of an officer to watch and see that nothing was done by night or day in preclusion of the rights of M. Liebert. In consequence, the officer of the court, accompanied by a police officer, and carrying an officially-stamped slip of paper, presented himself at the Opera at the height of the fête. This *coup de theatre* in a place whose frequenters are accustomed to similar *contretemps* did not give rise to so much disturbance as might have been expected. Fortunately for the success of the philanthropic work, for whose benefit the operations had been undertaken, the operations were not interrupted, so that the charity was no loser.

Up to this point nothing extraordinary had taken place. All that had occurred was in regular order. The owner of the patent had obtained an injunction against a rival whom he had accused of infringing it. This may be seen every day, only, perhaps, not generally at a charitable fête in the Opera House. But the unexpected part of the affair came afterwards: M. Pierre Petit, in reply to his opponent, acknowledges that he operates with an electrical apparatus diffusing light by means of a converging pencil of rays, but he asserts that he has wronged no one, for, the system employed by him being public property in France, he had a perfect right to make use of it. For the very reason that he believed himself to have that right, he did not think it necessary to pay for it, as M. Liebert had done. In a word, he laughs at the English patents of M. Vander Weyde.

Now what will M. Vander Weyde do in this case? Will he be satisfied to be considered as having invented nothing? Will he submit to the imputation of having illegally accepted payment for licenses to work an invention the right to which up to the present no one has dared to deny him—an invention for which he had received the applause of all the world, and the honors and profits for which were thought to be legitimately his due? As may be seen, the question is a complicated and a difficult one. The courts of law are called upon to settle it, and their judgment—which, of course, will cause all rights legally acquired to be respected—is awaited with impatience.—*K. Versnaeyen, in Photographic News.*

ENGINEERING INVENTIONS.

A device for moving cars by hand, consisting of a lever having a hook for attachment to the axle and a dog pivoted to the lever and arranged so that it will engage the flange or rim of a car wheel, has been patented by Mr. William B. Newlon, of Fremont, Neb.

Mr. Stoddart Howell, of New Orleans, La., has invented an improved wharf for rivers, harbors, and lakes. It consists in the combination of metal straps with the mortised cross pieces and stringers of a wharf, and other novel features of construction, which render it possible to build wharfs of any desired length and size in a shop or inclosure and afterward to put them up very quickly.

An improvement in windmills has been patented by Mr. Francis M. Wilson, of Tekamah, Neb. It has an arrangement of an eccentric and double crank shaft, by which it is claimed a much larger percentage of power is realized than in the ordinary mills.

An improved press for baling cotton and other substances, patented by Mr. Innes T. McIntyre, of Carrollton, Miss., consists in the combination of two pivoted movable followers and two levers coupled together, and provided with tackling for moving them both in the same direction. This movement moves one of the followers up and the other down, so as to compress the bale which lies between them.

Mr. Daniel Palacios, of New York city, has invented an improved oscillating pump. The pump cylinder is connected at its lower end with a hollow rock shaft or pipe, which communicates with the pump valves. The piston rod is connected with a crank on the pump driving shaft.

Mr. George Corbett, of Petrolia, Pa., has devised an improvement in oil, gas, and salt well apparatus. The improvement relates mainly to the construction of the framework that supports the moving parts of the machinery, the object being to make the framework stronger and more convenient to erect and adjust.

Mr. Francis J. Wehner, of New Orleans, La., has invented an improved compressing apparatus, the object of which is to compress semi-fluid substances, or substances of a granular character, and especially for crushing slabs of ice and forcing the pieces into a solid mass.

An improvement in pumps, patented by Mr. Cornelius E. Drake, of Avoca, Iowa, consists of a cylinder having its edges recessed to receive the packing rings, the rings being arranged so that they are kept in contact with the inner surface of the cylinder by the pressure of the water.

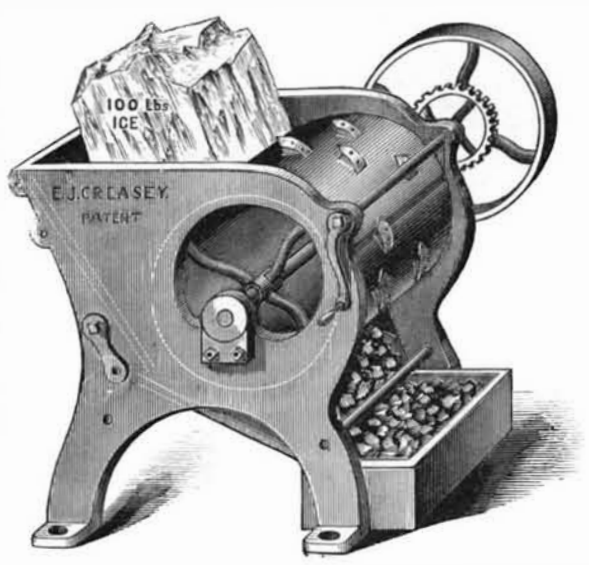
Mr. Samuel G. Munn, of Chicago, Ill., has patented an improved feed water heater, which consists of two water reservoirs connected by pipes running through a steam chamber insulated from the external air by a double shell or jacket. Pipes are provided for supplying and exhausting the water from the reservoir.

An improvement in steam packing rings has been patented by Mr. George C. Phillips, of Silver City, Nev. It consists in making segmental packing rings with recesses in their periphery, in which the water from the condensed steam collects and thus prevents them from over-heating or fusing under the heat of the steam.

Mr. William Redmond, of Greenville, S. C., has patented an improved rotary valve, consisting of two tubular valves fitted in concave seats at opposite ends of the steam chest, and communicating with the steam pipe through the side of the chest.

NEW ICE BREAKER.

The accompanying engraving represents a cheap and simple ice breaker, which picks the ice without breaking or crushing it. The size of the cut may be varied without stopping the machine. The machines are made in different sizes to suit different trades; the larger ones may be run by hand or power.



CREASEY'S ICE BREAKER.

The construction of the machine will be readily understood by reference to the engraving. The picks, which are of the best steel, are placed in a revolving cylinder or drum, and may be readily removed or replaced.

Further information may be obtained by addressing the Novelty Machine Works, 1608 S. Front street, below Tasker, Philadelphia, Pa.

Advantages of Fancy Farming.

The *Scientific Farmer* has a very sensible article on the advantages to a rural neighborhood, of having merchants and other well-to-do city people purchase homes in their midst. These people, says the writer, buy a suburban or more remote farm, bring to it of their wealth, remodel the old house or build anew, tear down or improve the old barns, and build from designs of a city architect who understands more of harmonies than uses, stock with improved breeds of cattle, the latest style of implements in endless variety, and the most expensive novelties from the seed stores, and spend, perhaps without hope, certainly without prospect, of adequate returns. Wherever fancy farms abound, there may be observed continuous improvement in their vicinity. They serve to change the habits of life of the farmer and his family. The old inconvenient methods of housekeeping give place to a more convenient system. The water from the well is brought to the house, instead of being fetched in a pail from the distant well or spring; the wood-pile is placed under a shed or into a compact pile, instead of being heaped in the door-yard; the surroundings to the buildings are "slicked up"; flowers appear, perhaps, in the door-yard; the cattle are better fed, the fences better repaired, new crops and new markets are sought, and expenditures are increased as the income grows larger and is derived from more varied sources. All this comes from the influence of the example of the finely but expensively maintained farm, whereon neither expense nor income is much considered, and which, judged from a business stand-point, must be considered a failure; judged from influences on others, is to be looked upon as a public benefaction.

There is too prevalent a feeling of jealousy towards the fancy farmer on the part of the actual farmer, and too little appreciation of the benefits which may be and are derived from his presence. It is to this leisure class of farmers that agriculture must look for that progress which results from unrest, abundance of means, and a strong enthusiasm towards a pursuit. This man can experiment, when the poorer man cannot afford to depart from the beaten rut until better results from a departure become demonstrated. This class encourage inventors and dealers by furnishing opportunities for the trial of new things which promise well, and when through costly failure an improvement is secured, the working farmer can secure the perfected article. This class import foreign cattle and test their adaptation to our needs. They introduce new fruits and improved vegetables, which, if found deserving, soon find distribution throughout the neighborhood. They extend a knowledge of the arts of culture, and tend to distribute a practical knowledge of hotbeds and forced crops; and in addition to these more obvious benefits, contribute largely, through taxation, to the public necessities, and relieve in this way the burdens on others.

How Typhoid Fever may be Propagated.

In a recent number of the *Popular Science Monthly*, Ely Van De Warker, M.D., of Syracuse, N. Y., under the title "Typhoid Fever Poison," reports seventeen cases of the fever in an isolated suburb of the city in which there were but fourteen houses. The first case was imported; thence through the overflowing of the privy in which all the excrement of the patient had been thrown, a well became contaminated. All the persons who were taken ill used this well. It was the constant or occasional source of supply of seven of the fourteen families. No cases occurred in the households who did not drink from this well. Some cases were developed in every family who drew water from it. The families who escaped were exposed to every other influence but that of this particular well; their own water supply was the same, less the privy contamination. It is not unlikely that their own wells received some of the overflow from their own vaults, but as these were free from typhoid poison, no ill results ensued.

About eight years since, Dr. Flint, who has studied and written a great deal on the subject, became satisfied that a source of typhoid fever existed which was little dreamed of, and which at first thought would seem impossible. This source, as he then enunciated it to his home medical society (and not to his knowledge having been before suggested), is found in *ice*. If this idea is thoroughly investigated, it will not appear to be very problematical. In the first place, the poison is not destroyed or impaired by freezing (some one long ago remarked that ice often masks or conceals what it does not kill). Now, whence comes our ice supply? Often from shallow reservoirs in the midst of neighborhoods of large towns purposely made to receive surface drainage from all around, under the erroneous idea that no harm will ensue, as freezing is supposed to purify and render harmless what might otherwise be objectionable. Great quantities of ice are taken from canals, from creeks, from stagnant ponds, and from streams that are either the natural or artificial recipients of surface drainage, of the outpourings of sewers, and of uncleanliness from various sources. The danger from ice taken from improper places is not only from that which is drunk, but from its use in refrigerators and preservatories, where milk, butter, fruits, vegetables, and meats are subjected to its saturating influence as it vaporizes. Several instances have fallen under the doctor's observation where the disease, by the most careful investigation, could not be traced to any other source; and if we accept as a fact the statement positively made by Budd in the London *Lancet*, in July, 1859, that it never originates *de novo*, but proceeds from a special and specific poison, which is capable of diffusion to a great extent, and which preserves its noxious qualities for a long period, even if buried for many months, we cannot reject the hypothesis of ice infection; and it is hoped that it will be made the subject of very thorough and careful investigation.

How Business is Now Done.

The old methods of doing business are fast passing away, and whether the change is for the better or not, those who wish to achieve success must abandon the old and fall into the new. A revolution has been wrought in such matters, and the old methods are daily becoming obsolete. One hundred thousand commercial agents or drummers are now employed to travel the length and breadth of the country in the interest of their employers, and in this fast age no one, unless he holds a monopoly of some good thing, can afford to wait for customers, so great is the competition in every line or branch of business. As pertinent to this subject, the Boston *Post* says: "The ways of traffic are not the old ways; wooden ships are going out of date, and sailing vessels are giving place to steam; currency is superseded by commercial credits; the cable and telegraph have brought markets close together; railroads derive their freight profits from the perfectness of their terminal facilities; men buy and sell by sample before products and manufactured stocks are moved; prices and rates change oftener now in a day than they used to do in a week or a month; everything tends to economy of business friction, to bringing things down to the finest point by the shortest way, to the performance of the most work by the least machinery."

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

The best results are obtained by the Imp. Eureka Turbine Wheel, and Barber's Pat. Pulverizing Mills. Send for descriptive pamphlets to Barber & Son, Allentown, Pa.

Steam Tug Machinery, Engines, Boilers, Sugar Machinery. Atlantic Steam Engine Works, Brooklyn, N.Y.

Park Benjamin's Scientific Expert Office will send an engineer to Europe on Aug. 7. Manufacturers and others desiring reports on foreign machinery or processes, business commissions executed, or information obtained, can have same done on moderate terms. Address 37 Park Row, N. Y.

Holly System of Water Supply and Fire Protection for Cities and Villages. See advertisement in SCIENTIFIC AMERICAN of this week.

Electro-Bronzing on Iron. Philadelphia Smelting Company, Philadelphia, Pa.

Wm. Sellers & Co., Phila., have introduced a new Injector, worked by a single motion of a lever.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Having enlarged our capacity to 96 crucibles 100 lb. each, we are prepared to make castings of 4 tons weight. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

Wanted—A new or second hand 150 h. p. vertical, automatic cut-off, condensing engine, that will run 160 revolutions per minute. Address, giving description and price, Ypsilanti Paper Co., Ypsilanti, Mich.

Vertical Engines. F.C.& A.E. Rowland, New Haven, Ct.

We want to make some heavy, patented machinery, on royalty or otherwise. Vulcan Works, Toledo, O.

Steam and Gas Fitters' Tools a specialty. Send for circulars. D. Saunders' Sons, Yonkers, N. Y.

Wanted—Good new pressure Hydraulic Motor, guaranteed under 40 to 60 lb. pressure, 3 in. supply, to run trams carrying 20 to 30,000 lb. on incline 42½°, 360 ft. long, 250 ft. high. Builders of inclines and mining engineers address, with plan, etc., latest tramway improvements, C. B. Maedel & James, Exchange Place, Kansas City, Mo.

Manufacturers and other owners or occupants of large buildings will conserve their interests by sending for samples and price lists of H. W. Johns' Asbestos Liquid Paints. H. W. Johns Mfg. Co., 87 Maiden Lane, New York, sole manufacturers of genuine Asbestos materials.

Telephones repaired, and parts of same for sale. Address P. O. Box 205, Jersey City, N. J.

Improved Dynamo-Electric Machines for Electroplaters and Stereotypers. Price $75 for 150 gallon machine. Equal to the best, at half cost of the cheapest. J. H. Bunnell, Electrician, 112 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

H. Prentiss & Co., 14 Dey St., New York, Manufs. Taps, Dies, Screw Plates, Reamers, etc. Send for list.

For Screw Cutting Engine Lathes of 14, 15, 18, and 22 in. Swing. Address Star Tool Co., Providence, R. I.

The Horton Lathe Chucks; prices reduced 30 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

Lincoln's Milling Machines; 17 and 20 in. Screw Lathes. Phœnix Iron Works, Hartford, Conn.

Boilers ready for shipment. For a good Boiler send to Hilles & Jones, Wilmington, Del.

A Cupola works best with forced blast from a Baker Blower. Wilbraham Bros., 2,318 Frankford Ave., Phila.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams, B'klyn, N. Y.

Linen Hose.—Sizes: 1½ in., 20c.; 2 in., 25c; 2½ in., 29c. per foot, subject to large discount. For price lists of all sizes, also rubber lined linen hose, address Eureka Fire Hose Company, No. 13 Barclay St., New York.

Nickel Plating.—A white deposit guaranteed by using our material. Condit, Hanson & Van Winkle, Newark, N.J.

The Lathes, Planers, Drills, and other Tools, new and second-hand, of the Wood & Light Machine Company, Worcester, are being sold out very low by the George Place Machinery Agency, 121 Chambers St., New York.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon & Co., 470 Grand St., N. Y.

Excelsior Steel Tube Cleaner, Schuylkill Falls, Phila., Pa.

Partner wanted. See adv. on page 30.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 29.

Band Saws a specialty. F. H. Clement, Rochester, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Wanted, the address of parties who manufacture steel tubing; also iron tubes. Address L. F. Standish & Co., New Haven, Conn.

Noise-Quieting Nozzles for Locomotives and Steamboats. 50 different varieties, adapted to every class of engine. T. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 30.

Factory Fire Hose.—A large lot good Cotton Hose for sale cheap. W. F. Corne, Agent, 117 High St., Boston.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

The American Watch Tool Company, Waltham, Mass., can cut standard Taps and Screws from 1-100 of inch diameter upward, of any required pitch.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

We have opened a sample depot for American goods, and wish to negotiate with manufacturers seeking Spanish markets. We shall be glad to receive catalogues, price lists, and samples of American products. Address Herrero Hermanos, Cadiz, Spain.

Hand Fire Engines, Lift and Force Pumps, for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N.Y., and 93 Liberty St., N. Y. city, U.S A

Combined Universal Concentric or Eccentric and Independent Jaw Chucks. Pratt & Whitney Co., H'tf'd, Ct.

NEW BOOKS AND PUBLICATIONS.

BOLETIN DE LA SOCIEDAD DE GEOGRAFIA Y ESTADISTICA DE LA REPUBLICA MEXICANA. Tomo IV., Nos. 4 and 5. 1879.

We have already had occasion to call attention to the great scientific value of the papers read before the Geographical and Statistical Society of the Mexican Republic, and to the excellent style in which they are issued. The current number (a double one) of the Society's "Bulletin," recently received, maintains the high character of those that have preceded it, and contains, in addition to a record of the "Proceedings" for July, 1875: A Resume of Recent Discoveries in European and Asiatic Archæology, by Senor Brackel-Welde; Altimetric Data, by Senor Reyes; A Memoir on a Means for Improving the Canalization of Mexico, by Dr. de Belina; A Report on the Cultivation of the Mulberry and the Rearing of the Silkworm in Colima, by Senor Moreno; A Paper on the Origin of Belize, by Senor Carrillo y Ancona; Facts relating to the Discovery of the New Mineral Barcenite, by Senor Ramirez, wherein the author, while claiming for his countryman, Senor Mendoza, the priority of discovery of the new species, grants that the honor of making the first quantitative analysis of it belongs to Professor Mallet, of Philadelphia, and that the name "barcenite" given to it by the latter should be accepted; A Memoir on the Moon and Meteorology, by Senor Reyes; Influence of Altitude on the Life and Health of the Inhabitants of Anahuac, by Dr. de Belina; and The Law of Periodicity of Rains in the Valley of Mexico. In addition to the foregoing memoirs, there are several unsigned papers and translations; and, altogether, the collection is one of considerable scientific interest.

REVISTA GENERAL DE MARINA. Cuaderno, 5. May, 1879: Madrid

This ably edited Review, now in its fourth volume, is a monthly periodical of about 75 pages, most excellently printed and copiously illustrated, and devoted to the interests of the navy exclusively—being in fact the sole organ of that branch of the Spanish service. We cannot give the reader a better idea of the scope of this interesting and valuable publication than by enumerating its contents, which, in the number before us, are as follows: Santa Cruz (Teneriffe) and the Fisheries of the African Coast, by Captain Galiano; Reflections on the Formation of the National Navy, by Captain Manganos; Brief Notes on the Recent Progress in Portable Firearms, especially in France, by Lieutenant Toca; Description of a New Hydraulic Dock; The Archer and Clark Stanfield System of Raising Sunken Ships, by Lieutenant Pastorin; and "Various Notes," under this heading being included short accounts of the most recent discoveries and improvements in matters appertaining to the navy.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) C. E. A. asks: 1. Can a boat be propelled by letting steam direct from the boiler through a nozzle under the boat pointing toward the stern? A. Yes. 2. If so, at what speed can a flat bottomed skiff, sharp at both ends, 15 feet long, 2 feet wide at bottom and 3 feet wide at top, with an upright boiler with 10 feet heat surface, with 120 lb. of steam, be propelled? A. If with the stream, the speed would be perceptible, but if against it, the stream would have the advantage. 3. Does a bullet thrown from a rifle cut with a gaining twist increase in revolutions after it has left the gun? A. No. 4. Why does a ball thrown from the same rifle make a larger hole in an animal at a long distance than at a short distance? A. Because at the short distance the substance is cut before it has time to yield.

(2) J. N. writes: Having occasion to use compressed air, and storing as large quantity as possible in a vessel containing 5 feet, if I pump air in so as to have a pressure of 15 lb. to the inch, how many feet can I discharge through a gas meter; or, in other words, how many feet of air can I pump into the vessel to make a pressure of 15 lb. to the inch? A. A quantity equal to the capacity of the vessel.

(3) "Young Mechanic" asks: 1. What branches of school study are the most necessary for a person intending to become a first class mechanic to be well versed in? A. Chemistry, physics, and mathematics. 2. What is the best book on mechanics for him to study first? A. The class books used in high schools and universities.

(4) F. W. S. asks: Which of two journals will wear the most, one running in wooden boxes and the other in metal ones, other conditions being equal? A. Those that run in wood; the wood holds dirt and grit, and all the wear falls on the journal.

(5) C. C. W. writes: I am building a small steam launch of the following dimensions: Length, over all, 18 feet, beam amidships, 4 feet 6 inches; draught aft, loaded, 18 inches; Clinker built, sharp lines, 2 plain valve engines, 2x4 inches, set on the quarter. I intend carrying 40 lb. steam and speed 200. What size screw do I need, and what pitch to do the best possible work? Please explain the principle of the injector. A. 22 inches diameter and 2 feet 8 inches pitch, you will get a moderate speed. For an explanation of the action of the injector consult Bourne's Catechism of the Steam Engine."

(6) E. P. asks. 1. Is water compressible? Is the water compressed to an appreciable extent at great depths in the ocean, 4 or 5 miles? A. Practically, no. 2. Would a wreck in sinking in the deepest part of the ocean reach a depth where it would remain stationary, owing to the density of the water, before touching bottom? A. If its specific gravity is greater than that of water it will go to the bottom.

(7) W. V asks how lime can be removed from water pipes in a dwelling house. They have only been in use two years, and all soft water which passes through them becomes so hard as to be useless. A. The lime salts cannot be removed by chemical means without doing injury to the iron pipes. Carbonic acid water (soda water) would probably dissolve the greater part of the salt with the least injury to the iron.

(8) S. S. S. asks how to separate lead from silver on a small scale. A. To separate the silver from a rich lead expose it in a large cupel (a porous dish made of bone ash, to a strong red heat, in a muffle open at both ends so as to admit of the passage of air over the melted metal. Under these circumstances the lead gradually becomes oxidized to litharge, which is absorbed by the porous dish, leaving a nearly pure button of silver and gold behind. On a larger scale Keith's new electro-chemical process gives very good results.

(9) J. J. W. asks how much tannic acid it would require to be used in a seventy-five horse power boiler. We use water slightly impregnated with lime, and forms a slight coating in about a month. What effect would the acid have upon the water distilled from boiler when the acid is used? A. We cannot recommend the use of tannic acid in a boiler under these conditions. Use ¼ ounce of soda to the barrel of feed water instead, and use the blow out every day.

(10) H. J. K. asks: Do you know of any substance, flexible, elastic, and at the same time transparent, to be used in place of wire in constructing a small machine? It must be of sufficient strength to sustain the weight of an ounce. A. Make a solution of fine gelatine in an equal weight of hot concentrated glycerine. If properly prepared and cooled slowly the resulting substance is nearly as flexible and elastic as caoutchouc, and semi-transparent.

(11) D. A. B. asks: If a chain suspended by both ends from above, the bight passing around a sheave below, to which a weight is attached, say 10 t ons—is there more than 5 tons strain, on any section of chain: if so, where is the breaking point? A. No; the breaking point will be in one of the parallel sides.

(12) W. J. R. asks: Would a pair of engines, 8 inches bore and 9 inches stroke, give good results at 200 revolutions, working steam at about 30 lb. mean effective pressure? What would be a better proportion? A. It would not be economical; you had better get same speed of piston by longer stroke and less revolutions, if your work will permit it.

(13) J. J. F asks what is the heat conducting power of terra cotta, and what is the conducting power of iron? A. Taking the conducting power of gold at 1000, iron is 374, terra cotta 11.

(14) J. J. S. asks for the simplest and best method of making a lightning arrester for acoustic telephones. A. Surround the wire for a distance of three or four inches with a copper tube having a number of internally projecting points, which come very near the wire but do not touch it so as to interfere with its vibrations. The copper tube should be connected with a ground wire having good ground connections. See p. 395 (26), current volume.

(15) J. M. L. asks: What is the matter with a Blake transmitter when it loses its force? Is it the fault of transmitter or of the battery? If in the battery how can it be corrected? A. The trouble probably lies in the Leclanche battery. Put a small handful of sal-ammoniac in the jar and add a little water. If this does not remedy the difficulty you should write to the manufacturers.

(16) J. W. S. asks: 1. How large should the steam supply pipes be to make the pressure on the piston the same as that in the boiler? How large should the steam supply and ports be in proportion to the engine? A. It depends upon the pressure of the steam and velocity of the piston; usually ¼ the diameter of the cylinder is sufficient for the steam pipe, but with high speeds it should be larger. 2. How do you change the lead in an engine? A. By shifting the eccentric. 3. How much lead should an engine, 11x20, with a small fly wheel, have? A. If running at usual velocity, from 1 16 to 1-8 inch will answer.

(17) S. B. M. asks: Which requires the most power, to run a piece of machinery with cog gear or belting? A. If a large power is to be transmitted at a slow speed, the belt; if a small power at high speed, gearing.

(18) C. S. writes: I am running a cider mill and press. Would like to know which is the best, canvas or cloth, through which to press the finest ground apples? A. Fine haircloth, with a backing of strong unbleached muslin, is generally preferred, we believe, where a sand filter is not used.

(19) J. B. Z. asks what to use in steam boilers to keep them from rusting, and also what is the best article to paint the outside with. A. Fill them entirely full of water and close them up tight. Keep the outside coated with a good oil paint—brown oxide ground in pure linseed oil.

(20) J. A. M. asks: Are glass insulators indispensable or not in putting up lightning rods on buildings, for protection against the electric current? Some parties have been putting up rods here without insulators, using only strips of zinc to hold them to walls and roofs. Our people are ignorant on the subject, and would be glad to see a full explanation in your valuable scientific journal. A. Insulators should not be used. The rod should be fastened directly against the building. But the most important precaution is to make sure that the bottom end of the rod has a large conducting surface in contact with the earth. Better have no rod than simply to stick the end a few feet down into dry earth; the proper way is to solder the bottom end of the rod to a metal water pipe or gas pipe in the ground. If there are no pipes, then make a long trench and put in some good conducting material, such as fine charcoal, or hard coal dust, iron ore, or old iron, making a good connection between the bottom end of the rod and this conducting material.

(21) N. W. asks what thickness of iron to use to make the shell of a small steam boiler, about 18 inches high and 10 inches in diameter, steam pressure about 50 lb. to the square inch. A. 1-16 inch, if of good iron and well made, but we would advise not less than 1-12 of an inch.

(22) L. S. asks: What size keel would be suitable for a cat rigged boat, 12 feet long, 4½ feet wide? A. 1½ inch by 3 inches deep would probably answer, but one or two inches deeper would be more weatherly.

(23) C. C. asks: 1. Will one cubic foot of iron swim in the water if the water is 20 miles deep? A. It will sink. 2. It is said that the wall of a cistern should be built a little distance from the dirt wall. Is this correct? A. To sustain the wall, keep the earth packed close to it.

(24) C. M. writes: On page 330, present volume, Professor Wilder is made to say: "For acid poisons give acids." 1. Is this a mistake? If not, in what cases would acids be antidotes for acid poisons, and in what cases would they be harmful or dangerous? A. The statement of Professor Wilder about acids—"*similia similibus*, etc.," may well be questioned by the correspondent. Where poisonous doses of acids have been taken, the best antidotes are calcined magnesia, chalk, lime, magnesia carbonate, etc., exhibited with plenty of cold water. Every effort must be speedily made to excite vomiting. Acids are never exhibited as antidotes for acids? See "Horsely on Poisons," and Marbai's Toxicology, p. 34. 2. What is the remedy for arsenious acid? A. We believe there is no specific antidote yet known for this poison. Perhaps the most effective antidote, if administered at an early stage (otherwise remedies in this connection are rarely attended with success), is recently precipitated moist ferric hydrate, or a mixture of this with magnesia. It is most advantageously exhibited in the form of a mixture of solution of ferric chloride (liquor or tintura) with sodium carbonate—two to three ounces of the former to one ounce of the crystals of the latter. Instead of the sodium carbonate, a quarter of an ounce of calcined magnesia may be used. These quantities will render at least 10 grains of the arsenic insoluble. No chemical antidotes should ever supersede active evacuent treatment by emetics and the stomach pump.

(25) E. L. W. asks what to apply to the wooden bottom of an aquarium to render it waterproof. A. Linseed oil, 3 oz.; tar, 4 oz.; resin, 1 lb.; melt together over a gentle fire. If too much oil is used the cement will be too soft. This may be corrected by adding tar and resin, or by allowing it to simmer for a longer time. Apply warm, and do not use the aquarium for several days.

(26) J. D. asks: 1. If height of water be 17 feet, overshot wheel be 13½ feet, gate 4 feet wide and opened 1½ inch, and discharging the water 3½ feet below the surface (or at a height of 13½ feet); and again, if the height be 16 feet and all the rest be the same, what is the actual horse power in each case? A. If you have stated your case correctly: Under 16 feet fall, the power would be with wheel 4½ feet face, 11·8 horse power; under the conditions given, the power with 17 feet fall would be no more, as the water is to be delivered under the same head, viz., 3½ feet; but if this is an error, and with 17 feet fall you intend to deliver the water under 4½ feet head, the power of the wheel would be increased to about 13·4 horse power, provided the wheel and buckets are so proportioned as to receive the increased quantity of water without waste. 2. What is the number of cubic feet of water that will pass through in 1 minute in each varying height (17 feet and 16 feet)? A. 306 feet under 3½ feet, and 347 feet under 4½ feet head.

(27) I. J. M. writes: In your answer to T. E. W., No. 35, volume XL., No. 24, you decide against him. Are you not wrong? We are taught that bodies at the center of the earth weigh nothing; if so, they can certainly have no momentum. As they approach the center, gravity decreases, until at the center the attraction is equal on all sides, and having no momentum, come to a state of rest. A. We think not; the accumulated work or momentum must be expended. Gravity cannot vibrate a pendulum when hanging vertically, but draw it aside and let it swing, and the accumulated work carries it past the center line, and it continues to vibrate until friction and the resistance of the atmosphere have destroyed or used up the momentum.

(28) W. E. C. asks: 1. How can I mould a porous cup for a Bunsen battery? A. They are unglazed porcelain, and cannot be made to advantage except by a potter. 2. What solution is used on the outside of the porous cup? A. Use a saturated solution of common salt or water 15 parts, sulphuric acid 1 part. 3. How many ½ gallon jars would be required to work a telegraph line ⅛ mile in length? A. Without knowing the resistance of your line we cannot tell; try two. The gravity battery is much better adapted to telegraphy than the Bunsen.

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(29) W. G. W. writes: 1. If 100 cubic inches of air were pumped into a hollow ball, and this ball would just hold up a given weight in the water, say 10 lb. and no more, would pumping 200 cubic inches in the same ball cause it to hold up any more than 10 lb. on the water? A. No, not so much by weight of air. 2. If three cubic inches of water be converted into steam, will the steam weigh as much as the water did? A. Yes. 3. If one gallon of water was converted into steam and confined in the same measure, what pressure per square inch would it have? A. You cannot convert water into steam and confine it in the same space; it will still be water, and can only change to steam by giving it room to do so.

(30) S. B. M. asks: 1. Can I make a simple and cheap battery, using copper or zinc, or both, without mercury? A Yes. 2. If so please tell me how. A. See SUPPLEMENTS, Nos. 157, 158, and 159, Batteries. 3. To insulate copper wire for an electro-magnet, will common wrapping twine do? A. No, it makes the covering too thick. Use a fine floss. 4. In wrapping wire on an electro-magnet, what do you mean by "layers?" Is it the number of times the wire is wrapped around it? A. It is the number of coils, counting from the core outward.

(31) G. B.—See Professor Wilson's paper "Hygiene of the Hair," in No. 110, SCIENTIFIC AMERICAN SUPPLEMENT.

(32) C. D. W. asks: Would not one paddle or bucket have the same propelling power swept through the water a distance of twenty feet, as twenty paddles or buckets on an endless chain one foot apart, the chain revolving on wheels twenty feet apart—the paddles the same area, and the same power applied to the single one and to the twenty? A. It will depend upon the velocity at which the paddles are driven; if so slow that the water can fill in perfectly between them, the increased number of buckets or paddles will do the most work, if, on the contrary, the speed is so great, that the water cannot fill between the buckets, then the single bucket will do the most work.

(33) H. C. M. writes In answer to S. C. C., April 10, (13), you said that when a train of cars are rounding a curve the greater weight is on the outside rail; please explain. A. The centrifugal force of the train round a curve acts to overturn the cars upon the outer rail, as the center of gravity of the mass is some distance above the top of the rail.

(34) G. T. C, asks: Does an overshot water wheel, when exercising a steady power by means of a crank attached to its shaft, exercise, or is it capable of exercising, more power at one point of revolution than at another? A. More pressure, but not power; the difference in pressure is owing to the different positions of the crank, not to any variation in the power of the wheel.

(35) E. A. W. writes: We would like to know from what height and into what liquid the copper is dropped to make it assume the granulated form, and if a tumbling barrel is afterward used? A. Pour the fused copper in as thin a stream as possible from a height of about a yard into a tub filled with cold water. A trace of sulphuric acid may be added to the water, but this is not essential. Dry the copper in sawdust, by tumbling or otherwise. Consult Larkin's and Overman's "Founder's Guide."

(36) W. F. L. asks: 1. Is it possible to line pulleys so that the belt will run horizontal and be quarter twist without the use of guide pulleys? A. Yes. 2. If so should they (the pulleys) be lined the same as in answer to A. W. D., SCIENTIFIC AMERICAN, of January 11, 1879? A. Yes. 3. I use well water in boiler, and notice in blow-off cock, which leaks some, a dirty looking scale, of which we send sample; do you think it will prove injurious to boiler? A. The incrustation consists chiefly of lime, iron oxide, silica, and alumina. If such an incrustation is permitted to increase there will be danger of overheating the plates. A small quantity (a few ounces) of carbonate of soda may be introduced daily with the feed water, and the blow-off used regularly every day, if possible after the contents of the boiler have remained quiescent for a time. Care should be taken that the water does not run low.

(37) E. C. L. writes: A discussion having arisen among some of our shipbuilders and ship owners regarding the capacity of iron and wooden ships (that is, our spruce ships) to carry dead weight, a great difference of opinion arose on this matter, and it was proposed to refer the question to you to be answered in your columns. Say a ship of 1,000 tons register, same proportions, one built of iron, the other of spruce, which would carry the greatest amount of dead weight cargo? A. It is generally estimated that iron ships will carry from 20 to 25 per cent more dead weight than an oak built ship, and it would probably be from 10 to 15 per cent more than a soft wood ship.

(38) G. M. F. asks: What is the most practical way of protecting Swiss drawing instruments against rust? A. Coat the warm metal with a very thin lacquer of shellac dissolved in alcohol.

(39) S. F. writes. Suppose a hollow globe to have the air exhausted from it, thus containing a perfect vacuum, will it then weigh more or less than it will when filled with hydrogen? A. Less.

(40) G. A. H. writes: A late number of the SCIENTIFIC AMERICAN contains the following question and answer: "What is it that carriage makers use for setting the boxes in the hub, with some kind of cement? A. The boxes are usually secured by wedges. We do not know of a cement that will answer the purpose." The "cement" used is white lead and oil mixed about the consistency of paste. A box set properly in this cement, provided the oil used for lubricating the axle arm does not penetrate the hub and thus soften the cement, will remain perfectly tight until worn out, and cannot then be forced out from the hub only by means of a powerful press, without breaking the box. Wedging the boxes by manufacturers of the finer grade of carriages, is looked upon with disfavor. With the common axle box (of which very few are now used), the shape necessitated wedging. The most improved patterns now made require no wedging for the purpose of tightening the box, wedges being used only for "truing" the box, so that the rim shall not present a wabbling appearance when the vehicle is in motion. Even this is now found to be unnecessary when the best hub boring machines are used, provided the rim of the wheel has not been forced out of true in setting the tire. Sometimes, and especially with a cheap grade of wheels, the smith is unable to set the tire without bringing the rim out of true, for the reason that proper care has not been observed in selecting the spokes. The same grade of timber is not used in all, therefore some spokes will be stiff and less flexible than others. The result being that the more flexible spokes dish more than those which are stiff, producing a rim out of true, and requiring that the box shall be trued in order to remedy the fault. When the rubber cushioned axle (now the most popular) was invented, it was found to be impossible to set one of the boxes by driving, therefore a press was made that answers the purpose of forcing in the box. The practice followed of forcing the boxes of other grades of axles, until now it is considered to be the easiest, safest as regards breaking, and the most durable method for setting a box; proper care being observed in forcing, the necessity of truing the box is obviated.

(41) J. M. writes: A says that printing is done on cylinder presses from ordinary movable type set in a cylinder which revolves. I say it is not. Which is correct? A. R. Hoe & Co. make a rotary press having one large cylinder on which the movable types are placed. The impression cylinders surround it; they vary in number in the different presses, 2, 4, 6, 8, and sometimes 10 cylinders are used. Fine printing is done on cylinder presses having flat reciprocating beds for receiving the movable types.

(42) T. Q. asks: What can I use to harden the tips of my fingers? Through daily practice on the violin they become very tender and sore, so that I have to cease playing. A. Continued practice will do it A strong solution of alum in water, or the tincture of white oak bark applied occasionally, may be beneficial.

(43) M. R. asks how the brine is made in which eggs are packed to preserve them. A. Dissolve rock salt to saturation in water and add about 5 per cent of niter.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

Buffalo Gap.—57. The fossil is too badly damaged to admit of proper classification. 120. A magnesian limestone. 143. Argillaceous limestone. 146. Argillite containing partially decomposed orthoclase, iron, and copper sulphurets. 133. Argillaceous limestone containing small quantities of chalcopyrite. 127. A fossiliferous clay slate containing a small amount of lime phosphate. 144. Consists chiefly of lime carbonate and phosphate, and clay. 123. Marcasite, an iron sulphide. The other (unlabeled) samples consist chiefly of argillaceous and ferruginous limestones containing small amounts of organic matters.—E. C.—1. Silver bearing galena (lead sulphide) associated with hematite and iron sulphide in quartzose and doleritic rock. 2. The amount of carbonaceous matters in the shale is small. Its color is chiefly due to iron oxide.—J. F. S.—The sample is kaolinite containing a small quantity of undecomposed orthoclase and sand. As it is almost entirely free from iron it may prove valuable in the manufacture of white "stone china," etc.—W. S. H.—It consists chiefly of charcoal saturated with partially decomposed alkaline thiosulphate. The quantity sent was insufficient for confirmatory tests. Charcoal and the alkaline sulphites are excellent antiseptics. – J. R. —The rock contains nothing of any practical value.—The sample of fire clay in unlabeled tin box (Lawrence's patent) is of fair quality value, about a dollar a ton in New York.—O. B. McN.—Quartz pebbles of no value.

COMMUNICATIONS RECEIVED.

Complexity *vs.* Simplicity. By G. F. W.
On Consumption. By D. F.
Boat Rig. By G. A. C.
On Scientific Credulity. By G. T. B.
On a Method of Fumigating Vessels. By C. S.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 17, 1879,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

Air engine, compressed, W. R. Eckart 216,563
Air engine, compressed, Hardie & James 216,611
Amalgamator and concentrator, G. R. Evans 216,564
Ax-pocket, A. Crosby 216,605
Axle box, car, D. A. Hopkins 216,517
Axle skein, vehicle, N. L. Holmes 216,615
Axles, spring washer for vehicle, D. Dalzell 216,512
Bag fastener, W. Terrell 216,583
Baling press, H. Parker 216,694
Ball trap, B. F. Wright 216,590
Bed, spring, A. Underwood 216,634
Beer, swimmer for cooling, L. D. Biersach 216,550
Belts, friction compound for, F. Brown 216,596
Birk cage food holder, F. C. Bowen 216,651
Boot and shoe, P. Cox 216,660
Boot strap, H. M. Weaver 216,544
Bottle stopper, C. G. Hutchinson (r) 8,755
Bridle bit, G. P. Butler 216,653
Broom and brush head, G. Iveson 216,570
Buckle, hame, W. C. Huston 216,570
Bung bush, Lacey & Cornell (r) 8,759
Burial casket, L. W. Drake 216,513
Butter stamp, W. Hart 216,674
Butter-worker cooler, H. C. Warner 216,635
Button, F. W. Richards 216,701
Can case, G. W. Banker 216,497
Car brake, J. Bachmann 216,495
Car, oil, M. C. Brown 216,506
Car starter, Moore & Svedberg 216,525
Carriage brake, child's, Weston & Maynard 216,546
Carriage curtain fastening, F. Baumgartner 216,499
Cartridge capping and uncapping implement, F. A. Canfield 216,554
Cartridge holder, O. R. Luther 216,620
Cartridge, pyrotechnic signal, A. H. Bogardus 216,552
Chain, leather, C. F. Rumpp 216,533
Chain link, C. A. Chamberlin (r) 8,761
Change box, A. Bradford 216,647
Churn, D. Schweikhard 216,578
Churn dasher, A. H. Bell 216,643
Churn power, J. Faubel 216,665
Clothes bar, J. P. Mallette 216,621
Clothes drier, B. Knopp 216,683
Clothes line, etc., fastener, J. Bohlen 216,646
Clothes pounder, L. Coplin 216,604
Copy holder, C. S. Caldwell 216,654
Cornet, D. J. Blaikley 216,595
Corset, L. M. & M. D. Chipley 216,555
Curtain fixture, balance, J. M. Osgood 216,692
Dental plugger, R. B. Donaldson (r) 8,763
Desk, school, C. F. Hill 216,676
Ditching machine, Toops & Braddock 216,709
Door bolt, J. R. Payson 216,695
Door fastener, S. L. Chase 216,602
Door, grain, T. Sills 216,580
Door sheave, sliding, M. Roberts 216,702
Door spring and check, combined, R. C. Love 216,688
Drawing board, G. W. Da Cunba 216,662
Dredging tube, pneumatic, W. P. Lewis 216,686
Dumb waiter, W. F. Holske 216,568
Dummy figure, J. A. Gillotte 216,610
Dust pan, S. M. Perry 216,529
Ear holder, F. C. Batcheller 216,498
Elevators, belt safety attachment for, C. L. Page 216,528
Evaporating pan, A. Brear 216,649
Extracts and distilling liquids, apparatus for making, M. Cziner 216,557
Fastening strip or clasp, J. H. Weaver 216,543
Faucet, A. Moore 216,627
Faucet, measuring, D. A. Hauck 216,675
Faucet, water, H. H. Craigie 216,661
Faucets, automatic weighing attachment for, Hawley & Anderson 216,567
Fence, barbed wire, E. V. Wilkes 216,637
Fence barbs, machine for making, R. A. Belden 216,594
Fence, wire, Wilson & Grimes (r) 8,757
Fertilizer distributer, W. Hodges 216,671
Fifth wheel, vehicle, J. A. Bilz 216,551
File holder, C. E. Cochrane 216,657
Fire alarm, T. N. Roberts 216,576
Fire escape ladder, Hayes & Free (r) 8,758
Fruit Jar, J. H. Stamp 216,707
Fuel, manufacture of artificial, C. Hassel 216,613
Funnel, measuring, J. Pfitzenmeier 216,530
Furnace and Stove, J. C. Stuart 216,539
Gas burners, apparatus for automatically regulating the flame of, I. & A. Herzberg (r) 8,754
Gas, process and apparatus for manufacturing illuminating, R. M. Hunter 216,519
Gas, process and apparatus for manufacture of, Harris & Allen 216,612
Gas regulator, W. Cowan 216,556
Governor, pumping engine, E. L. Otis 216,693
Grain binder, Ross & Parker 216,532
Grain, bobbin of wire for binding, R. C. Fay 216,666
Grain crushing machine, porcelain roll for, W. Braun 216,553
Grain drill, E. M. Morgan 216,572
Grate bar, F. Steele 216,708
Grave guard and tombstone, M. Beckler 216,500
Harness coupling, Reynolds & Hayes 216,700
Harness for preventing horses from kicking, W. Smith 216,705
Harvester reel and dropper, A. C. & R. W. Sriver 216,706
Hay and cotton press, E. Beadle 216,642
Hay elevator and carrier, W. L. Kinsey 216,521
Heel breasting machine, E. May 216,623
Heliotrope, J. W. Garner 216,565
Hose jacket, fire, C. B. Allaire 216,639
Hub attaching device, O. C. Mason 216,524
Husking pin, W. E. Hall 216,672
Hydrocarbon vapor burner for heating purposes, H. H. Eames 216,562
Ice cream freezer dasher, J. H. Dunbar 216,607
Ink for printing protective tints on commercial blanks, E. Mendel 216,625
Insect destroyer, G. H. Hull 216,679
Insect destroying machine, W. M. Hicks 216,614
Invalid rocking chair, C. Sundquist 216,582
Ironing and seam opening machine, J. T. Bruen 216,507
Irrigation pipe, E. M. Hamilton 216,673
Jewelry, plated, A. Vester 216,586
Knitting frame take-up, W. H. Carr 216,655
Lamp, Burnap & Cope 216,652
Lamp burner, J. Trent 216,542
Lamp burner cone, J. Trent 216,540
Lantern, J. Trent 216,541
Last, repairing, W. J. Crowley 216,509
Lasting machine, J. W. Hatch (r) 8,764
Lasting machine, R. C. Lambart 216,685
Lathe center, adjustable, A. A. Robinson 216,703
Lemon squeezer, C. J. Reynolds 216,699
Lock, L. Bensel 216,502
Loom shuttle, J. Burton 216,503
Lubricator, W. P. Phillips 216,531
Manures, machine for distributing, Shaw & Williamson 216,579
Match box, E. B. Beecher 216,501
Meat chopper, E. M. Silver 216,536
Meat in cans, apparatus for packing, T. Houlahan 216,569
Meat, package for canned, T. Ashwell 216,494
Mechanical movement, D. Abrey 216,638
Middlings, flour, etc., feed roll for, C. A. W. Jaquett 216,617
Milk cooler, C. L. & S. P. Bacheller 216,640
Millstone driver, Smith & Cochrane 216,704
Millstones, dressing, D. Brubaker 216,597
Mirrors, protecting the backs of, G. W. Walker 216,587
Miter cutter, W. R. Fox 216,608
Monkey wrench, W. M. Green 216,516
Motion at regular intervals, apparatus for producing forward and backward, I. & A. Herzberg (r) 8,753
Motion, device for converting reciprocating into rotary, J. Skinner 216,537
Motion, mechanism for converting reciprocating into rotary, Ellis & Rule 216,560
Musical instrument, mechanical, M. J. Matthews 216,622
Nail picker and separating machine, M. A. Williams 216,713
Oils and fats, bleaching, J. Davis 216,558
Oxide, process and apparatus for manufacturing carbonic, Motay & Jerzmanowski 216,584
Pail, lunch, J. J. Tillinghast 216,632
Paper box, W. H. Tunis 216,711
Paper folding machine, Chambers & Mendham 216,598, 216,599
Paper folding machine, C. Chambers, Jr 216,600, 216,601
Paper making machines, felt guide for, J. Peaslee 216,696
Paper pulp, engine for preparing stock for making, C. Bremaker 216,505
Petroleum into a uniform, purified, and deodorized oil, converting crude, H. F. Howell 216,518
Picture exhibitor, P. Costa 216,659
Plane, H. B. Price 216,698
Plane stock, flexible faced, S. D. Sargent 216,577
Planter, cotton, T. M. Barna 216,548
Platform or mat, H. L. Palmer 216,573
Plow, J. Austin 216,592
Plow, riding, G. E. Wolcott 216,714
Printer's galley, T. T. McNish 216,689
Printing machine, plate, Kenworthy & Clark 216,681
Propellers, raising and lowering, J. W. Dilks 216,559
Pruning implement, A. J. Lytle 216,571
Pump, centrifugal, E. Chaquette 216,603
Punch, drill, shears, combined, Bates & Wild 216,641
Punches, shears, and stamps, mechanism for actuating, J. T. Bedford 216,593
Rag washing machine for rag and paper washing engines, J. Tyler 216,585
Railway rails, securing fish plates to, E. Bourne (r) 8,762
Railway switch, H. A. Norton 216,691
Rice hulling machine, E. Totman 216,633
Roof for sheltering grain, portable, J. R. Davis 216,606
Roofs and vessels and for other purposes, compound for covering, J. Wettendorff 216,547
Roofing plates, machine for bending sheet metal, J. F. Currier 216,511
Saw, drag, T. B. Fagan 216,663
Sewing machine, drag, W. W. Giles 216,668, 216,669
Scales, weighing, W. C. Farnum 216,514
Scraper, wheeled, G. J. Weber 216,588
Seal lock, J. J. Tillinghast 216,631
Sewing machine, T. Green 216,671
Sewing machine, button hole, J. J. Graff 216,670
Sewing machine hand motor, J. Bancroft 216,496
Sewing machine, straw braid, C. F. Bosworth 216,504
Sewing machine, elastic treadle for, J. W. A. Huss 216,616
Shingle cutting machine, J. H. Phipps 216,575
Shoe, A. Black 216,503
Shutter worker, W. Jones (r) 8,756
Sifting machine, N. Bassett 216,549
Skate, roller, J. M. Lewis 216,687
Smelting fine or dust ores, H. H. Eames 216,561
Sock protector, F. Smith 216,538
Speed regulating mechanism for cotton sliver eveners, J. R. Reilley 216,630
Stalk cutter, J. Kraft 216,684
Steam and air brakes, operating valve for, G. Westinghouse, Jr 216,515
Steam engine, E. S. Westcott 216,636
Stool, camp and hunting, J. Powell 216,629
Stove, C. F. Hill 216,677
Stove and furnace, summer, C. Truesdale 216,710
Stove board and table mat, H. L. Palmer 216,574
Stove, cooking, J. F. Allen 216,591
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Testimonials from England and Scotland.

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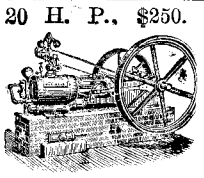

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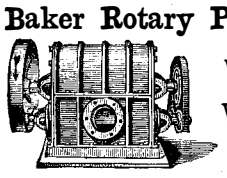

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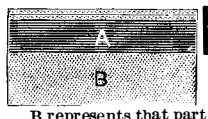

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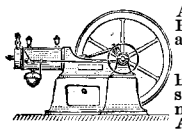

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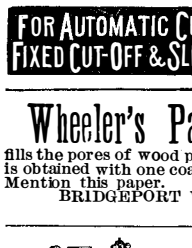

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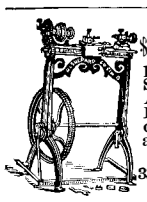

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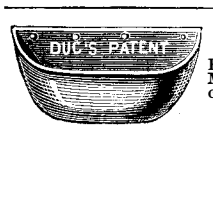

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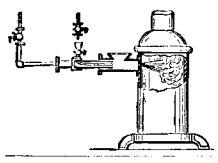

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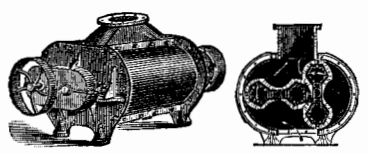

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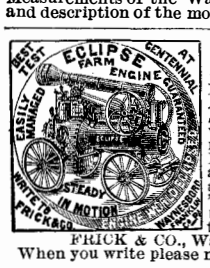

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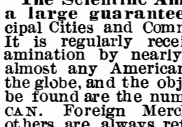

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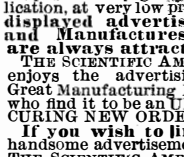

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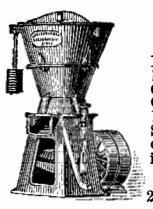

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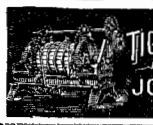

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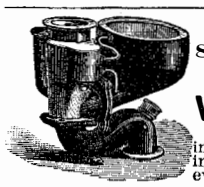

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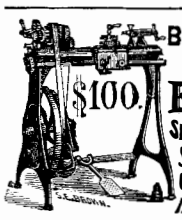

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